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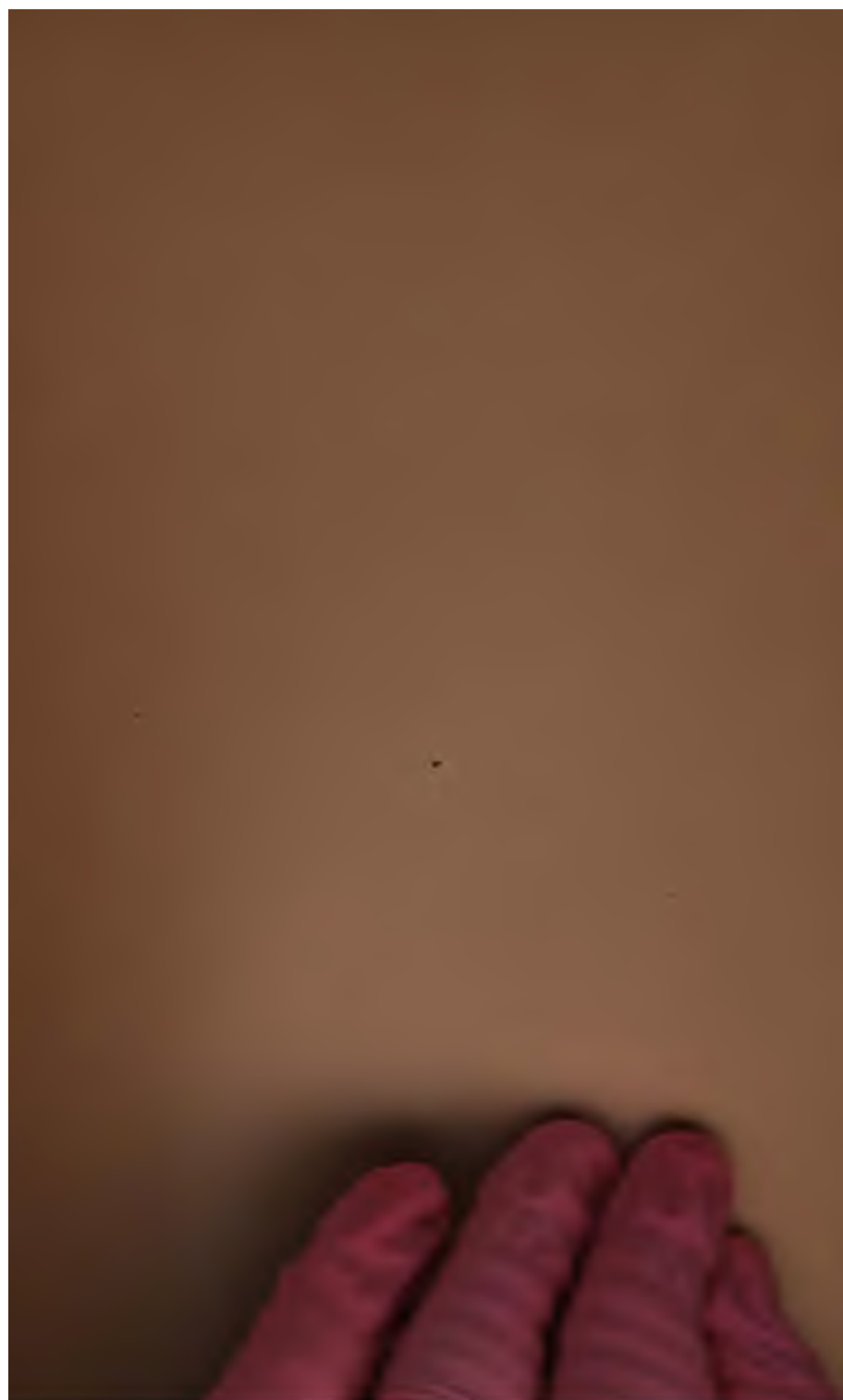
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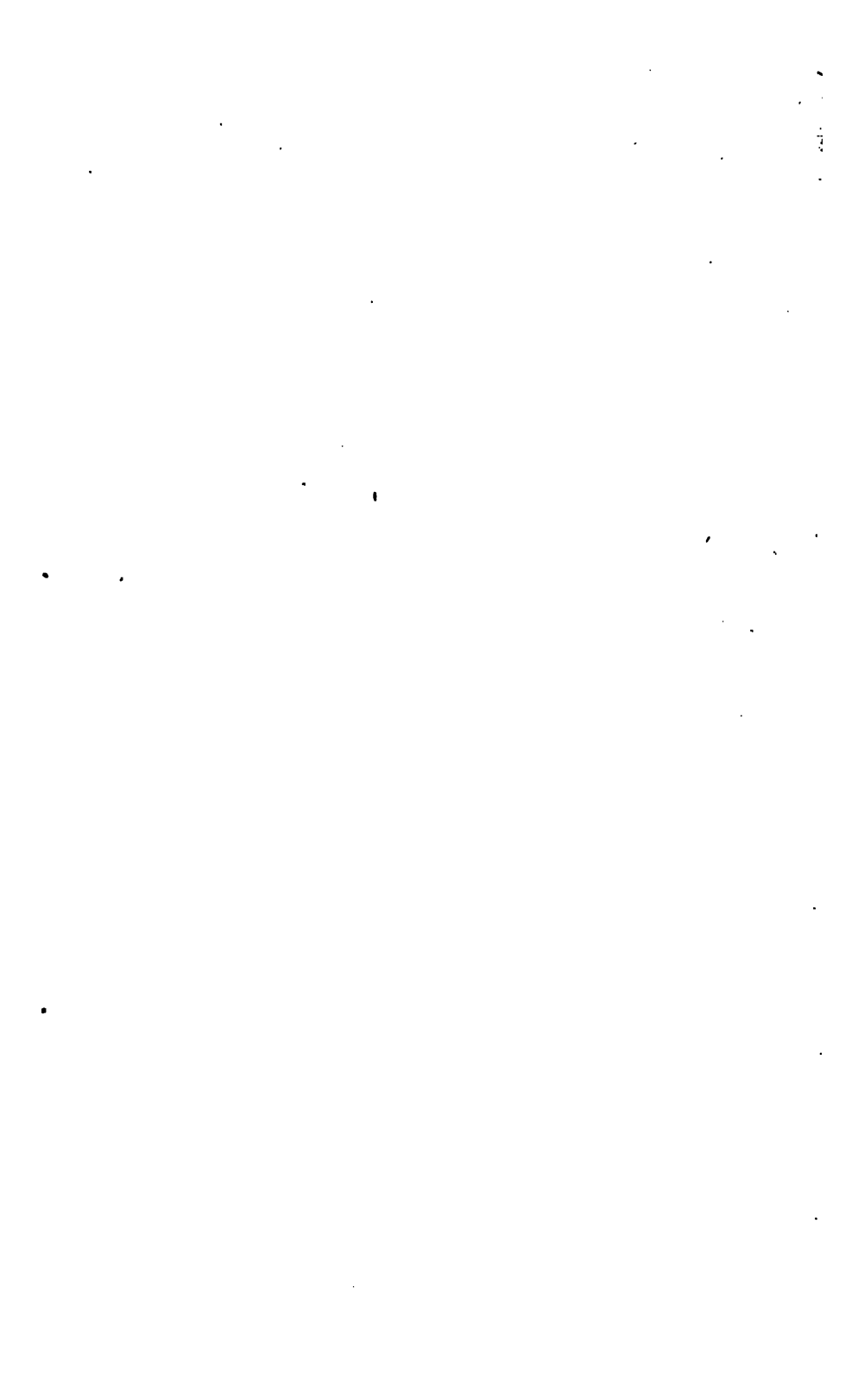
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# PROCEEDINGS

OF THE

## Royal Society of Victoria.

VOL. III (NEW SERIES).

*Edited under the Authority of the Council.*

ISSUED APRIL, 1891.

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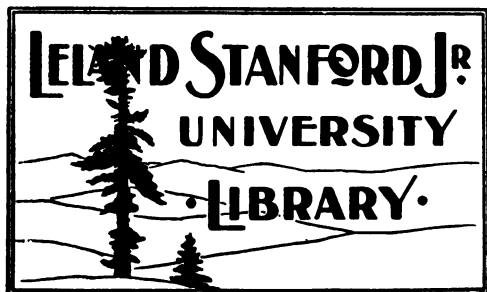
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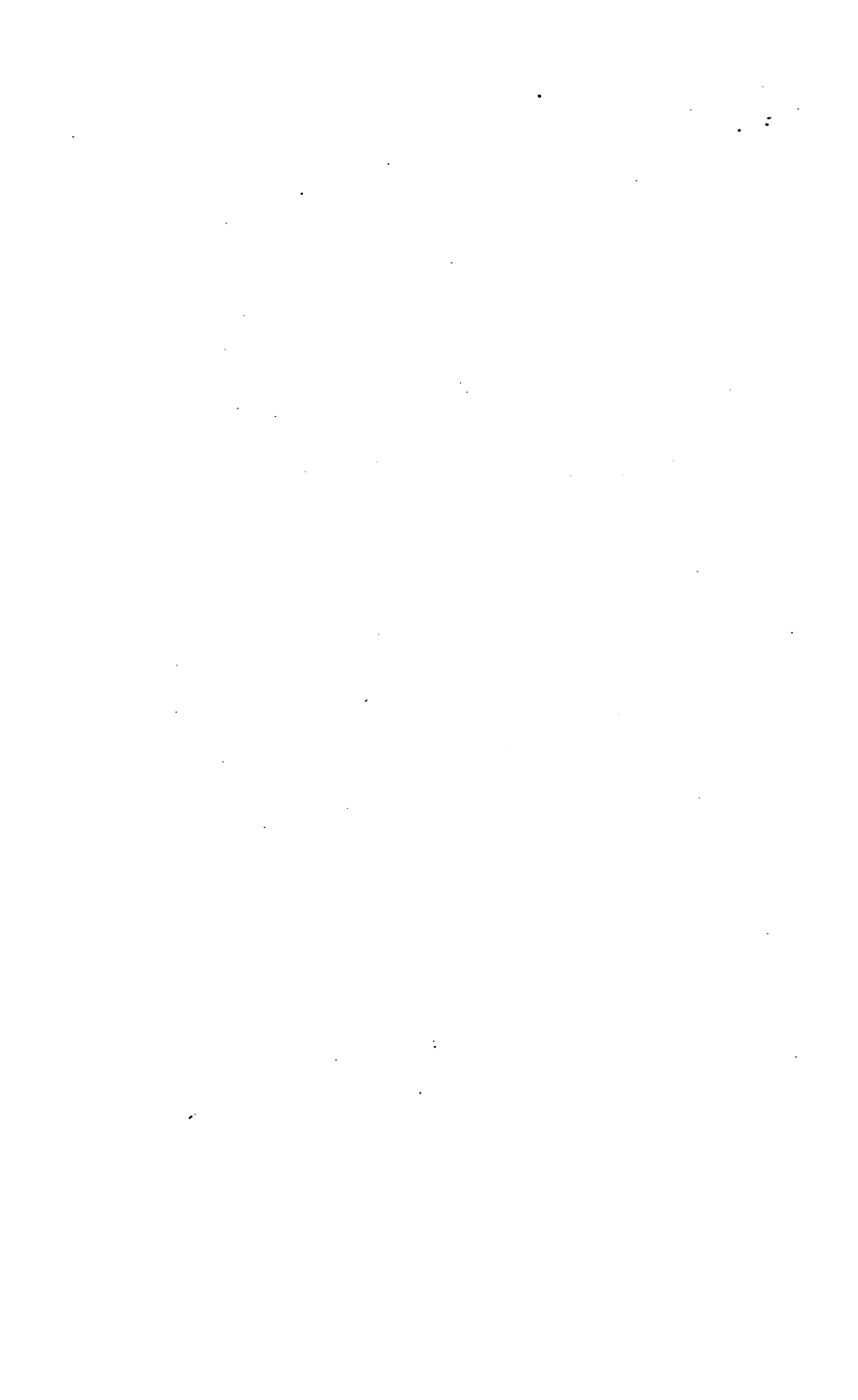
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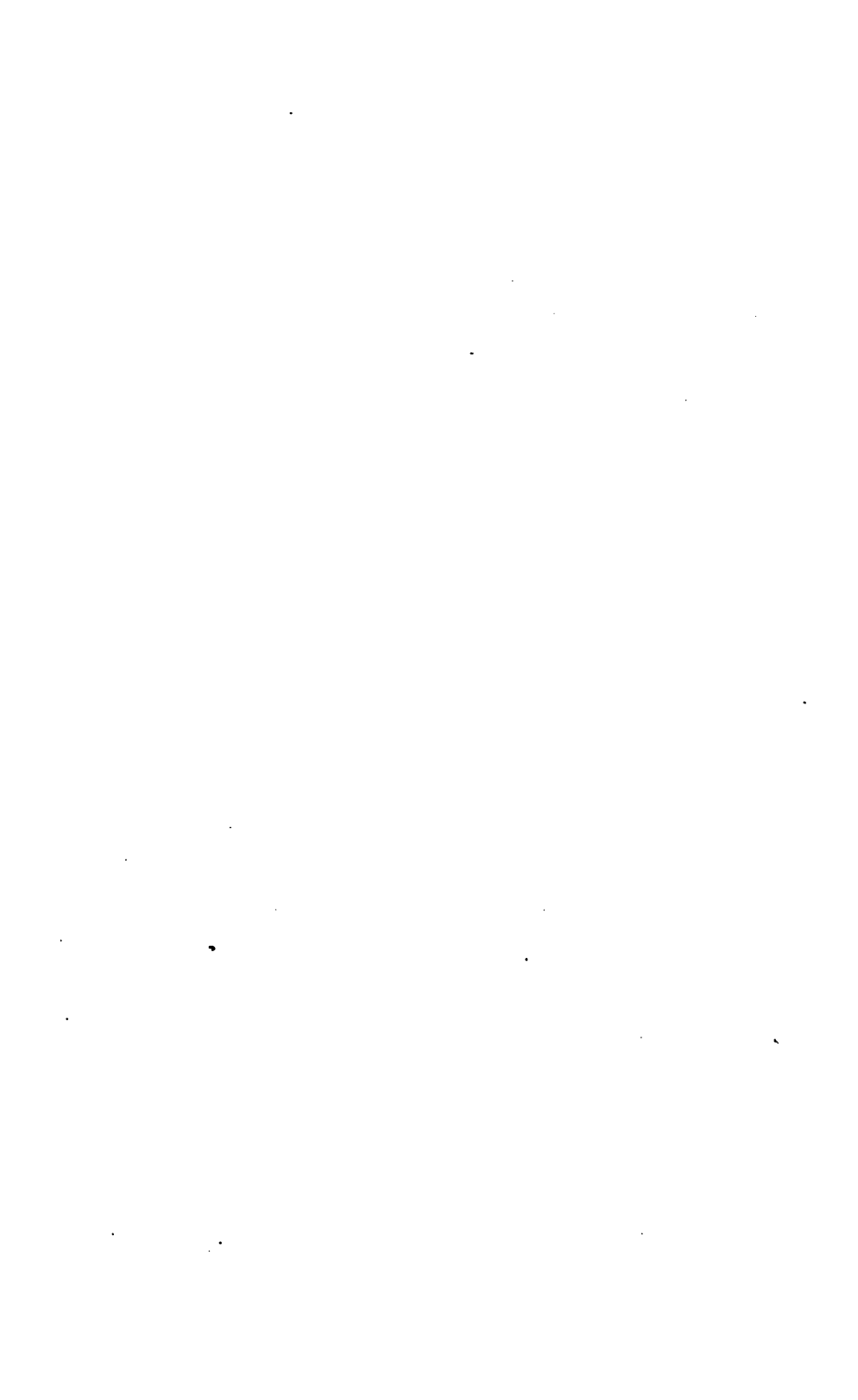


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# **PROCEEDINGS.**



ART. I.—*Notes on West Australian Oology, with  
Descriptions of New Eggs.*

(With Plates I and II.)

By A. J. CAMPBELL, F.L.S.

(Communicated by PROFESSOR W. BALDWIN SPENCER, M.A.)

[Read March 13, 1890.]

Having recently devoted myself to nearly four months of scientific research, particularly with reference to field work, in Western Australia, I desire to lay before this Society the following oological notes. Further, at this juncture, the notes may be deemed the more valuable, because the "West Australian Constitution Bill," now before the Imperial Parliament, is directing attention to the great western territory, from whence any knowledge is of peculiar interest at present.

*Astur cruentus*, Gould (West Australian Goshawk).—Eggs roundish in shape, bluish-white, with dull surface. In a clutch of two, one specimen possesses a few smudges of reddish-brown. Dimensions—(1) 4·4 x 3·46 cm., (2) 4·33 x 3·43 cm. These examples are from the Champion Bay District. I did not take them personally, but have no doubt of their identity. Gould states that this goshawk breeds during October and the two following months, making a nest of dead sticks on the horizontal fork of a mahogany (*Eucalypt*) tree.

*Podargus brachypterus*, Gould (Short-winged Podargus).—Eggs pure white, long oval in shape; texture of shell fine, with slightly lustrous surface. One example, from a clutch of two, measures 4·44 x 2·96 cm. They were taken 21st October with the nest (a thick platform of twigs, &c.), about 10 or 12 feet from the ground, in a paper-bark tree (*Melaleuca*), at Quindalup. This podargus sometimes places its nest in the fork of a grass tree (*Xanthorrhœa*), as well as in eucalypts. Dimensions of nest about 25 cm. in diameter, by about 5 cm. in thickest part.

*Strepera plumbea*, Gould (Leaden-coloured Crow-shrike).—A pair of eggs I took at Hamelin Harbour are of the usual

longish form, deep reddish-buff or brown, marked over the whole of the surface in an indistinct manner with a darker colour. Dimensions—(1) 4.53 x 2.97 cm., (2) 4.67 x 2.97 cm. Clutch usually three eggs. A specimen from the Champion Bay District is much lighter in colour, resembling those of *S. fuliginosa* of Tasmania, with smaller dimensions, namely 4.25 x 3.07 cm. But whether the variation in colour is caused by different food or specific difference, has yet to be ascertained. Colonists in Western Australia aver there are two species. I was disappointed I did not succeed in procuring a skin of the Northern bird. The nest taken at Hamelin, 17th October, was situated in the forked branches of a peppermint tree (*Agonis*). The structure was of tough twigs, firmly lined with grass, and measured 46 cm. over all, with an egg cavity 18 cm. across the mouth, by about 8 cm. deep.

*Gymnorhina* (sp.?) (Western Crow-shrike).—Believing the Western magpie to be different from either of the Eastern birds (*G. tibicen* and *G. leuconota*), I give a description of its nest and eggs, which however, closely resemble those of its allies. Nest is constructed of sticks and twigs, and lined first with bark, then with a ply about 2½ cm. in thickness of finer bark. Measurements over all about 30 cm., egg cavity 15 cm. across, by about 6½ cm. deep. The eggs, generally three in number, are very beautiful, resembling those of *G. tibicen* taken in Queensland. They are streaked or marbled with rich pinkish brown, upon a bluish or French grey ground. Dimensions—(1) 3.96 x 2.8 cm., (2) 3.86 x 2.76 cm., (3) 4.33 x 2.68 cm. September, October, and November, constitute the chief breeding months.

*Pachycephala occidentalis*, Ramsay (Western Thick-head).—In *Nests and Eggs* (1883), I adopted Gould's description; but since the Western is found to differ from the Eastern variety, and as some doubts exist as to which Gould described his eggs from, I have deemed it requisite to re-describe the eggs, together with a nest I took at Karridale, 28th October. The nest is firmly woven of grass and the soft green leaves of a certain plant, and lined with fine grass. Dimensions—about 9 cm. across, with a fairly sized egg cavity about 6½ cm. across the mouth, by 4 cm. deep. The whole securely set among the branches and seed pods of a *Hakea*. The eggs are light yellowish-white, of a darker shade about the upper quarter, where are spots of umber and dull grey,

the latter appearing as if under the surface of the shell. Texture of shell somewhat fine. Specimens long in shape, with both ends nearly alike. Clutch two; measurements—(1) 2.48 x 1.6 cm., (2) 2.47 x 1.6 cm.

*Sphenostoma cristata*, Gould (Crested Wedge-bill).—I have received several undoubted examples of the egg of this bird from the Gascoyne District, therefore, the habitat of the bird may now be extended to Western Australia.

*Gerygone culicivora*, Gould (Western Warbler).—Gould described accurately the position and structure of this bird's nest, but did not succeed in procuring the eggs, which are warmish-white, spotted especially at the larger end with reddish or pinkish-brown, after the fashion of the *Maluri* eggs. An egg, from a set of three, measures 1.7 x 1.17 cm. The nest was taken at Quindalup (Geographé Bay), from the topmost branches of a peppermint tree (*Agonis*), in September.

*Eöpsaltria georgeana*, Q. et Gaim. (White-bellied Robin).—Exceedingly little is known of this rare robin. The first nest that came under my observation was in a sheoak (*Casuarina*) sapling, bordering a creek in close proximity to the Tor Bay Timber Station, owned by Messrs. C. and E. Millar of this city. The second nest I took was in a thick forest, artfully hid in the fork of a grass tree (*Xanthorrhœa*), where the drooping rush-like foliage carefully concealed it. The nest is built of leaves, fine twigs and strips of bark, and lined with fine rootlets and grass. The specimen taken from the *Casuarina* was decorated outwardly with pieces of dead bracken fronds. Across, the measurement was about 9 cm., egg cavity 5 cm. by 3 cm. in depth. In each instance, the eggs were two, of a beautiful olive-green, one out of each set had a distinct bronzy shade upon the apex. Dimensions—*a* (1) 2.2 x 1.56 cm., (2) 2.13 x 1.52 cm.; *b* (1) 2.11 x 1.53 cm., (2) 2.06 x 1.55 cm.

It will be noticed that the nest and eggs of the White-bellied Robin, most resemble those of the Dusky Robin (*Amourodryas vittata*) of Tasmania, and are totally unlike the *Eöpsaltria*; therefore, it may be found necessary, now that the nest and eggs have been discovered, to alter the generic name of the former bird.

*Estrilda oculatea*, Q. et Gaim. (Red-eared Finch).—Nest of the usual bottle-shaped appearance, with the entrance through the neck slightly ascending before dropping into the egg chamber, or body of the nest. The structure is bulky,

consisting chiefly of a wiry grass (*Calostrophus*), and lined with brittle material and downy seed vessels. Situation chosen, generally *Melaleuca* trees on the margin of streams or swamps, sometimes *Banksias* or other thick bush. Eggs soft white; complement 4 or 5. Dimensions of two examples—(1)  $1.73 \times 1.22$  cm., (2)  $1.78 \times 1.22$  cm.

*Cacatua gymnopsis*, Sclater (Dampier's Cockatoo).—Eggs whitish, rather pointed towards the smaller end. Texture of shell somewhat granulated. Clutch is four in number.\* Mr. Woodward, F.G.S., informed me he had witnessed aborigines taking these cockatoos from the hollow of flooded gums on the Dalgety Creek, Gascoyne District. Young in down have been seen on the Upper Murchison in April; while Mr. Mackenzie Grant, M.L.C., and others, state that numbers of these birds breed under rocks on Dampier's Archipelago, off Nichol Bay. Although this cockatoo was only described by Sclater in 1871, it is really the oldest known of all the Australian cockatoos. Dampier, in August 1699, when in the vicinity of the Archipelago which now bears his name, recorded there was "a sort of white parrots which flew a great many together," and which undoubtedly refers to the bird now under consideration. Therefore, as a vernacular name for this interesting cockatoo, and as there are many inappropriate local appellations, I have taken the liberty of adopting the name of the celebrated navigator.

*Platycercus zonarius*, Shaw (Banded Parrakeet).—I was somewhat astonished to fall in with this beautiful parrot in the Champion Bay District. To Miss N. Logue, of Ellendale, I am indebted for an egg, and also to Mr. R. H. Cowan, for his assistance in aiding me to procure a series of skins. The egg which is white, was taken from a hollow eucalypt bordering the Greenough River, and measures  $2.84 \times 2.35$  cm.

*Euphema petrophila*, Gould (Rock Parrakeet).—Eggs of a fine texture, white, round in form, but some examples inclined to oval. A full clutch of 4 measures (1)  $2.45 \times 1.9$  cm., (2)  $2.42 \times 1.94$  cm., (3)  $2.5 \times 1.98$  cm., (4)  $2.45 \times 1.9$  cm.

I was singularly successful in securing a series of the eggs of this comely little parrakeet on Rottnest Island, where the birds breed (without any nest) under shelving or flat sand, or lime-stones, but invariably selecting rocky islets off the main island, notably Green or Parrakeet Island. It gives me pleasure to state, that Mr. A. H. Courderôt, a

---

\* One Example measures  $4 \times 2.82$  cm.

corresponding member of this Society, was the first to present me with the eggs of this graceful parrakeet, also with a pair of live birds which now adorn my aviary.

*Synoicus sordidus*, Gould (Sombre Swamp-Quail).—Eggs pyriform, of a dirty yellowish-white, minutely spotted all over with dull green or olive. Markings more assimilate those of the Tasmanian, and are a little bolder than the common swamp quail's (*S. australis*). Shells very thick. Complement of eggs, 8 to 10. Dimensions—(1) 3.04 x 2.46 cm., (2) 3.24 x 2.45 cm., (3) 3.16 x 2.44 cm.

On a visit to Breaksea Island, at the entrance to King George's Sound, I found this quail plentiful, and although late in the season (2nd January), the lighthouse keepers pointed out a nest containing nine eggs, and kindly permitted me to remove three for scientific purposes. The nest was a little hollow, lined with dead grass and sheltered under a tussock of grass amid rushes.

*Biziura lobata*, Shaw (Musk Duck), invariably lays a pair of eggs on the Eastern portion of Australia and Tasmania, yet, however remarkable and unaccountable it may seem, the complement is three in Western Australia. I heard of several nests with that number, and took one myself in a *Melaleuca* swamp at Karridale.

*Sterna dougalli*, Mont. (Graceful Tern).—Eggs rather round in form; colour varies from greyish to warm stone colour, boldly marked with spots and blotches of a dark umber, patches of grey also appearing under the surface of the shell. Clutch, two eggs. Dimensions—*a* (1) 3.8 x 2.93 cm., (2) 3.82 x 2.94 cm.; *b* (1) 3.96 x 2.82 cm., (2) 3.93 x 2.82 cm.

Gilbert, the able coadjutor of Gould, did not succeed in procuring eggs, but was informed that these terns breed in November. The following extract from my note-book would make it appear that December was the chief laying month:—"Graceful terns in companies of scores, found nesting on parallel dead coral ridges, Pelsart Island, Houtman's Abrolhos, 23rd December, 1889. Birds uttering usual shrieking cries. Eggs two, but sometimes one, the nest being a hollow made in the rough coral filled with finer coral, shells, &c. Coral, not the usual cream colour or white, but bluish-grey, as if by long exposure to the elements, and sustaining patches of lichen (*Lecidea*). On another ridge adjacent, were a few ternlets (*Sternula nereis*) breeding; also two eggs, sometimes one. Young in down

whitish, with pale-yellow feet and bill. Young in down of graceful tern white underneath, rest of surface slightly mottled; feet and bill pink. Eyes dark in both species."

In conclusion, I should like to record the dates and breeding localities of two petrels.

First.—The Fleishy-footed Petrel (*Puffinus carneipes*, Gould), which I found breeding on Breaksea Island, King George's Sound. The first eggs were noticed by the lighthouse keepers on 30th November, and were plentiful on 7th December. The same dates apply to Mutton-bird Island, Tor Bay, where some eggs were also collected on the mainland. This is the first instance, as far as I am aware, of petrels laying on the mainland of Australia. They invariably resort to isolated rocks or islands for the purpose of breeding. The burrows of the fleshy-footed petrels are mostly tunnelled in sandy soil, in an oblique direction from four to six feet, but sometimes to the depth of eight feet.

Second.—The Wedge-tailed Petrel (*Puffinus sphenurus*, Gould).—I first made the acquaintance of this nocturnal creature on Rottnest Island, where I obtained a couple of eggs on 22nd November. When I reached Rat Island (Houtman's Abrolhos), I ascertained the first eggs there were discovered in the burrows on 17th November, while the majority of eggs were collected the following week.

Some of the islands of the Abrolhos, which are about fifty miles off Champion Bay, for prodigious numbers of birds, brought to my recollection the journey of the Israelites, when quail fell among them. Truly it seemed to me, when upon Rat Island, that the face of the earth, as well as the sea, was covered with birds, "as it were a day's journey on this side, and as it were a day's journey on the other side," round about our camp. For there were noddy terns breeding as close as they could pack upon the bushes, sooty terns were croaking over their task under the bushes, while the ground underneath was honeycombed with petrels, moaning and groaning, especially at night, when it might be readily said, the whole island "groaneth and travaileth in pain."

Mr. G. K. Beddoes, C.E. (Manager of the Guano Station), and I, calculated that there were about 300 acres of Rat Island occupied by birds, and that they averaged at least one bird for every square yard, giving a total of 1,452,000 birds for one small island alone. Some of the photographs, exhibited to-night, will give a very fair idea of the flights and multitude of birds.





Fig 1.

Fig 2.





Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

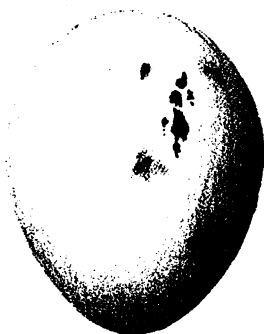


Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.

EXPLANATION OF PLATES.

PLATE I.

- FIG. 1.—Egg of *Eöpsaltria georgeana*.  
FIG. 2.—Egg of *Sterna dougalli*.  
FIG. 3.—Egg of *Gerygone culicivora*.  
FIG. 4.—Egg of *Pachycephala occidentalis*.  
FIG. 5.—Egg of *Astur cruentus*.  
FIG. 6.—Egg of *Synoicus sordidus*.  
FIG. 7.—Egg of *Strepera plumbea*.  
FIG. 8.—Egg of *Sterna dougalli*.  
FIG. 9.—Egg of *Strepera plumbea*.

PLATE II.

- FIG. 1.—Nest of *Eöpsaltria georgeana*, the White-bellied Robin.  
FIG. 2.—Nest of *Pachycephala occidentalis*, the Western Thickhead.
-

ART. II.—*On the Occurrence of Certain Fish in Victorian Seas, with Descriptions of some New Species.*

(With Plate III.)

By A. H. S. LUCAS, M.A. (Oxon.), B.Sc. (Lond.)

[Read May 8, 1890.]

I.—*Fish collected by Mr. J. Bracebridge Wilson, in his Dredging Excursions during the summer of 1887–8.*

(1) *Hippocampus breviceps*, Peters.

This little fish was found in abundance near Port Phillip Heads, by Mr. Wilson. We have also met with it on weed at nearly all our dredging stations in the Bay.

(2) *Hippocampus abdominalis*, Kaup.

Mr. Wilson forwarded one specimen from the Straits.

(3) *Syngnathus phillipi*, nobis.

Obtained by Mr. Wilson at nearly all the outer stations of Port Phillip in large numbers. A description is appended.

(4) *Chilobranchus rufus*, Macleay.

Very abundant at all stations near the Heads. Found also freely at Cheltenham.

(5) *Cristiceps australis*, Cuv. et Val.

Taken by Mr. Wilson at stations near the Heads in great abundance. I consider *C. howittii*, Castelnau, to be a form of *C. australis*.

(6) *Cristiceps wilsoni*, nobis.

Met in company with *C. australis*; abundant.

(7) *Cristiceps phillipi*, nobis.

With *C. wilsoni* and *C. australis*, but only three specimens forwarded. Descriptions of (6) and (7) are appended, as also outline figures.

- (8) Two species of *Gobius*, not yet determined, but probably new.
- (9) A single specimen of a fish belonging to the Labridæ. It is probably new, but more material is necessary for a proper description to be given.

II.—*Fishes obtained in the Port Phillip Biological Survey, Dredging, or Short Excursions.*

- (1) *Pegasus lancifer*, Kaup. From Sandridge.
- (2) *Stigmatophora argus*, var. *brevicauda* data, nobis. From Geelong Inner Bay.
- (3) *Sticharium dorsale*, Günther. From Laverton Bay ; abundant.
- (4) *Clinus despicillatus*, Richardson. From Portarlington and Sandridge.
- (5) *Callionymus*, sp. From Geelong.
- (6) One specimen of *Gobiosoma*, sp. From Brighton.

III.—*Fish obtained by Mr. J. Bracebridge Wilson, in the summer of 1888–9.*

In addition to those previously received from Mr. Wilson, were—

- (1) *Mordacia mordax*, Gray. One specimen ; young.
- (2) *Sticharium dorsale*, Macleay.
- (3) *Tripterygium macleayanum*, nobis.  
A single specimen ; description and figure appended.
- (4) *Syngnathus semi-fasciatus*, Günther.  
A single but large and typical female specimen.  
The colours exactly correspond with those given by Count Castelnau. P.Z.S. Vict., Vol. I, p 199.
- (5) *Hippocampus*, sp.  
I have not yet been able to satisfy myself as to the identity or novelty of this handsome specimen.
- (6) *Pristiophorus cirratus*, Latham.  
A male specimen, 33 inches long.

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(7) *Urolophus cruciatus*, Lacep.

Two male specimens, 11 inches and 6 inches long respectively. The younger showing the pattern of the colour markings very clearly.

(8) *Rhina squatina*, L.

A young female, 11 inches long.

(9) *Ostracion auritus*, Gray.

Two specimens, 7 and 7½ inches long respectively.

IV.—*Fish Trawled in Bass' Straits by the Government Steamer, "Lady Loch," in July 1889. Depth 10–39 fm.*

(1) *Upeneichthys porosus*, Cuv. et Val. (sp.)

One specimen. Between Belfast and Warrnambool, 25–27 fm.

(2) *Monacanthus rudis*, Richardson. One specimen.

(3) *Monacanthus guntheri*, Macleay. One specimen.

(4) *Cyttus australis*, Richardson. Two specimens, both young.

(5) *Trigla polyommata*, Richardson. One young specimen.

(6) *Lepidotrigla vanessa*, Richardson. One specimen.

(7) *Ostracion auritus*, Shaw.

Two specimens, each about 5½ inches long.

(8) *Cristiceps australis*, Cuv. et Val. One specimen.

(9) *Pempheris macrolepis*, Macleay.

A number of these fish were obtained between Portland and Belfast. The sailors called them Galldie. Only one specimen was forwarded. They do not often come to market. I have never seen one there.

---

*Cristiceps wilsoni*, n. sp.

D. 3/27-28/3. A. 2/21. V. 3. About two inches long.

Body compressed; height, one-fourth to one-fifth of total length. First dorsal inserted over operculum, rather longer than earlier rays of second dorsal. Ventrals not quite reaching to vent; caudal rounded; principal caudal rays, 11.

Second dorsal attached by membrane to base of caudal; anal free from caudal. Clear membrane between the first and the last two of the soft dorsal rays. Scales small, distinct. Lateral line continuous, with the curve usual in the genus.

Profile of head and snout convex; lower jaw slightly protruding; diameter of eye greater than length of snout. Supra-orbital tentacles red, simple, nearly as long as diameter of eye; snout tentacles pale, small, jointed.

Colour variable, as probably in all the species of the genus. Body colour reddish, with a number of vertical dark red-brown to rose-coloured bands, which may or may not be continued over the vertical fins. The first band incomplete below the first dorsal, two others on the trunk, and four on the tail. Colour-markings of head inconstant.

Dredged at several stations near Port Phillip Heads, by J. Bracebridge Wilson, to whom I have great pleasure in dedicating the species.

In a single specimen are found the following characters which I record, but do not wish to establish a new species. The present state of our knowledge of the species of this genus is eminently unsatisfactory, and the limits of variation have scarcely been considered :—

D. 3/24/3. A. 2/17. V. 3.

Body compressed; height  $4\frac{1}{2}$  in total length. Length 58 mm.

First dorsal situated above operculum; rays equal, not exceeding those of second dorsal. Ventrals reach about half-way to vent. Second dorsal united to base of caudal; anal free; scales minute and distinct. Supra-orbital tentacles simple, red; snout tentacles short, pale. Colour reddish, with vertical rows of interrupted black and yellow blotches. Vertical fins, with corresponding red bands; short white band from orbit across præoperculum.

This specimen is figured in Plate III, Fig. 1.

*Cristiceps phillipi*, n. sp. Three specimens.

(a) D. 3/30/2. A. 2/23. V. 2.

Snout rather pointed. First dorsal over operculum; second ray longest; third shortest; clear membrane between the two soft rays. Scales distinct; lateral line distinct anteriorly. Height about four times in total length. Pectorals nearly to vent; ventral rays long, slender; anal free from caudal. Supra-orbital and snout tentacles very short and small. Colours ill-defined in spirit specimen.

Length 67 mm. Dredged Port Phillip Heads, by J. B. Wilson, 1888-9.

This specimen is figured in Plate III, Fig. 2.

(b) D. 3/30/3. A. 2/23. V. 2.

First dorsal over operculum; first and second rays much longer than third; clear membrane between the soft rays. Scales distinct. Pectorals to vent; ventral rays long, slender. Height nearly five times in total length. Supra-orbital tentacles aborted, and snout tentacles short, but distinct. Colour, few vertical dark bands; white band from eye across præoperculum and operculum, continued along trunk and tail, below the lateral line to the root of the caudal. Length 53 mm. Dredged at Port Phillip Heads by J. B. Wilson, 1888-9.

*Tripterygium macleayanum*, n. sp.

D. 3/14/12. A. 22. L. lat. 25. L. tr. 3/1/8. P. 15. V. 2.

Height of body rather less than length of head, and about equal to length of tail-fin. Length of head constituting about two-sevenths of combined length of head and trunk, without caudal fin. Insertion of ventrals half-way between tip of snout and vent. Pectorals reaching nearly opposite to end of second dorsal. Scales with fine toothed edges. Lateral line distinct to opposite the fourth ray of the third dorsal. Eyes large, diameter about one-third length of head. Short fringed tentacles above orbit and at outer side of nostril. Inter-orbital space concave, narrower than diameter of eye. Line of fringed papillæ above and behind orbit. Rows of finely-toothed scales on sides of occiput, upper edge of operculum, and front of præoperculum. Colour (spirit) orange, with broad, indistinct, red vertical bands; eyes red; vertical fins pale, with black margins. Length of single specimen, 50 mm. It is figured in Plate III, Fig. 4.

Dredged by J. B. Wilson near Port Phillip Heads, summer of 1888-9. Dedicated to the Hon. Sir William Macleay, author of "The Ichthyology of Australia."

*Syngnathus phillipi*, n. sp.

D. 25-26. Osseous rings 18 + 40-44, reckoning the complete ring which bears the pectoral fins as the first body ring.

Adults between four and five inches long. Length of snout, about half that of head. Length of trunk, about

twice that of head. Length of tail  $1\frac{1}{2}$  to  $1\frac{1}{4}$  that of head and trunk together.

The actual measurements of four specimens are—

|     | HEAD.—SNOUT.                                           | Trunk. | Tail—Tail-fin.                                          | Total Length. |
|-----|--------------------------------------------------------|--------|---------------------------------------------------------|---------------|
| a ♀ | $\begin{array}{cc} 7.5 & 7.5 \\ \hline 15 \end{array}$ | 28     | $\begin{array}{cc} 75 & 3 \\ \hline 78 \end{array}$     | 121 mm.       |
| b ♂ | $\begin{array}{cc} 5 & 6.5 \\ \hline 11.5 \end{array}$ | 22.5   | $\begin{array}{cc} 62.5 & 2.5 \\ \hline 65 \end{array}$ | 99 mm.        |
| c ♂ | $\begin{array}{cc} 5.5 & 6 \\ \hline 11.5 \end{array}$ | 28     | $\begin{array}{cc} 65 & 2.5 \\ \hline 67.5 \end{array}$ | 107 mm.       |
| d ♀ | $\begin{array}{cc} 6.5 & 6.5 \\ \hline 13 \end{array}$ | 27.5   | $\begin{array}{cc} 59.5 & 2.5 \\ \hline 62 \end{array}$ | 102.5 mm.     |

Depth of trunk in males, one-fifth ; in females, one-fourth of its length. Dorsal fin occupies about two body and six tail-rings ; the egg pouch in the males extends over the first 15 to 18 tail-rings. Ridges very distinct on snout, rest of head, trunk, and tail.

A median dorsal on the snout, forking, opposite the middle of the eyes, into two low branches which join the supra-orbital behind the eyes. Supra-orbital prominent, converging in front of eyes to just reach the dorsal median of the snout, and continuing behind, as the upper lateral ridges of the head. Inter-orbital space concave ; median ridge on crown of head extending, once interrupted, to terminate opposite the insertion of the pectoral fins. Nuchal lateral ridges continuous, with upper lateral edges of trunk ; dorsal surface of neck much narrower than that of head or trunk ; horizontal ridge across operculum ; lateral ridges from tip of snout, diverging to the eye on either side. In the males there is a marked tetrahedral prominence on the ventral surface of the head, just behind the level of the eyes, formed at the point of union of the median ventral ridge of the snout, a transverse ridge along the origin of operculum on either side, and the median ventral ridge of the head, continuous with that of the trunk behind. This projection is quite wanting in the females.

Sides and back brown, with narrow, whitish, vertical bands near the front border of several of the lateral plates ; under surface lighter. Keel of ventral ridge of *trunk*, black. Males darker. In some of the males, white spots instead of bands : in some of females, rows of black spots across operculum and on under surface of snout. Upper

surface of head, operculum, and snout, with irregularly white lines, bands, or patches, more or less conforming to the ridges.

Dredged at Port Phillip Heads by J. Bracebridge Wilson. Named from the locality.

*Stigmatophora argus*, Rich., var. *brevicaudata*.

D. 49 or 50. Osseous rings 20 + about 60.

Snout 17 mm. } Head 25 mm. Trunk 46 mm. Tail 87 mm.  
Skull 8 mm. }

Dorsal spots black, without white edges. Green.

Differs from *S. argus* in relative length of tail, and in the absence of the white rings round the black spots. Spots arranged in six tolerably regular longitudinal series.

Dredged in seaweed, Geelong Inner, December 10, 1887.

Macleay's account of *S. argus*, Rich. T.Z.S. III, p. 183, Pl. 7, Fig. 2. Günther, Cat. VIII, p. 189.

D. 49-52. Osseous rings 20 + about 75.

Snout very long, about twice as long as the remaining part of the head. Operculum with a slight ridge in young examples, nearly entirely disappearing in old. Vent below the middle of the dorsal fin. Tail more than twice as long as the trunk; egg pouch shorter than the trunk. Upper parts with numerous small, black, white-edged ocelli, sometimes irregularly arranged, sometimes forming longitudinal or transverse series. Tasmania. Port Jackson.

## EXPLANATION OF PLATE.

Outline figures of some new Victorian Blennies. All the figures are life size.

Fig. 1.—*Cristiceps wilsoni*, n. sp. The variety noted is the one figured, but the general outline is that of the species.

Fig. 2.—*Cristiceps phillipi*, n. sp.

Fig. 3.—*Cristiceps australis*, Cuv. et Val. A young specimen, drawn for purposes of comparison.

Fig. 4.—*Tripterygium macleayanum*, n. sp.

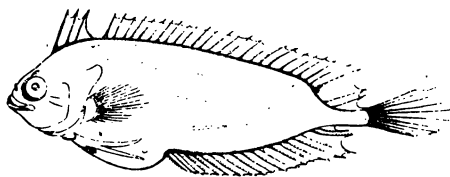


Fig. 1.

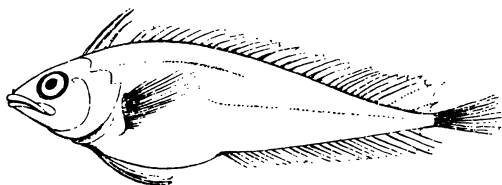


Fig. 2.

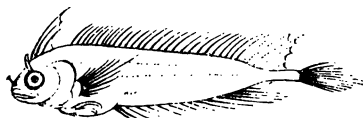


Fig 3.



Fig 4.



### ART. III.—*Anthropology in Australia*.\*

By A. W. HOWITT, F.G.S.

[Read Tuesday, May 13, 1890.]

For the first time in Australia the study of Anthropology has taken up a definite position, by the formation of Section E of the Royal Society of Victoria. It seems remarkable that the science of man should have been the last to have attracted special attention here, where there are unrivalled opportunities for its presentation in a country where man still exists in as nearly a primitive condition as it is possible to find in any part of the world.

It is certainly true, that since the time when the white man took up his abode in Australia, there have always been more or less numerous enquiries into native customs, commencing with Collins, who compiled his work called "An Account of New South Wales" in the early years of settlement. Since then, until now, there has been a constant succession of observers who, as explorers, settlers, and missionaries, have devoted more or less time and attention to enquiring into and recording the customs and the beliefs of the Aborigines who wandered over the Australian land. These works, and numerous detached accounts which are scattered through, and I may say buried in, the transactions of societies here and elsewhere, form a literature of considerable extent, and of very varied degrees of authority and value. In the great majority of these works, even in some of the most recent, which profess to be written with authority, it is dangerous for any one to accept the statements made without such knowledge on the part of the reader as will enable him to form an independent opinion.

The time has now come for this great mass of material to be digested, and for those portions which are of value to be extracted, circulated, and placed in such form that it may be possible to make some generalisation. I have long proposed to myself to attempt this in connection with a work on the

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\* An Introductory Address, read before Section E.

organisation and the customs and beliefs of Australian tribes, for which I have been engaged in collecting material for many years, both personally and through correspondents in the greater parts of Australia. These materials remain still in a great measure unused, but I am at present unable to form any opinion as to when the time may come in which the pressure of official duties will permit of my devoting the necessary leisure, not only to the condensation and arrangement of my own data, but also to the condition of the great mass of material in other works to which I have referred.

In this address I do not propose to enter upon any general review of the science of Anthropology in its Australian aspect, but to confine myself to tracing out briefly the progress and present position of that part to which my own special attention has been devoted—namely, the probable origin and development of social institutions. In this study, the origin and development of the family forms an essential element.

In investigations such as these, the white man who has been born and bred and trained in the ways of civilisation is at a disadvantage, unless he has had such intimate intercourse with savages as to enable him to place himself more or less in their mental standpoints, to see as they see, and to reason as they reason. Few white men have been in that position, and yet fewer of those have been competent to avail themselves of their opportunities.

Buckley and Morell, who will serve for examples, lived for years with Australian tribes, and they show how white men under such circumstances may not only descend nearly to the level of the savage, but after again rejoining their own people, are unable to give even as clear an account of the Aboriginal society, of which they formed a part, as an average blackfellow. So far as one can ascertain, they appear to have been quite ignorant of even the rules which govern the intermarrying classes of the community. Even educated men, with more or less scientific training, do not, as it would seem, always see matters which must have been directly within their view. I was struck by this when reading a late and interesting work by the naturalist Lumholz, on the "Aborigines of the Herbert River in Eastern Queensland." I observed that even he, after some four years of more or less intimate acquaintance with those people, does not seem to have seen much below the surface. He makes no mention of the laws governing their society, as regards marriage, nor does he seem to have seen or to have had des-

cribed to him the secret ceremonies of initiation to manhood, which must certainly exist, and which are most important as furnishing a key to many otherwise puzzling customs.

This, then, being generally the case with those who have personally observed these savages, what can be expected from those who have taken up the observations of others for the purpose of generalisation as to the origin of social institutions in the Australian tribes, or generally throughout the world. This becomes clearly evident when one considers the conclusions reached as to the origin of the family by Bachofen, McLennan, Mayne, and Morgan, who may be here taken as representing four well marked and progressive stages of opinion.

Bachofen, working altogether from a classical standpoint, elaborated a strange and somewhat grotesque hypothesis of a former universal gynecocracy. He held that of old mankind was found in a condition of universal hetarism, from which it was raised by the establishment of gynecocracy by women, as a continuous protest against the degradation to which man's superior physical powers had reduced her. It is evident that he saw, dull and distorted, as through a glass darkly, the traces of the Matriarchal system which was once universal, and which still exists among certain savage tribes.

McLennan, advancing a step further, built his theory on a wider foundation of classically extinct and modern existing custom, and saw, as he believed, the origin of the family in polyandry, which was brought about by a scarcity of women, produced by female infanticide. The actual existence of polyandry as a form of the family, the numbers of facts marshalled by him with consummate ability, both from ancient and modern sources, caused his theory to be widely accepted, and to have an authority which is still recognised by a section of anthropologists.

Mayne was led to form certain views by his investigation into the true character of early institutions as handed down to us by the archaic records of our own Aryan ancestors, illustrated by the existing customs of some of their descendants. He compared his results with the ancient records of Semitic peoples, and he arrived at the conclusion that the primitive form of the family was that known as the Patriarchal, in which the power of the father was predominant, and which was characterised more or less by polygamy.

Morgan had his attention drawn to these questions by his personal observations of the organisation of the Iroquois tribe, of which he was an adopted member. Following out the clue hereby gained, he spread his inquiries over the greater part of the world, and his final results were recorded in his work on "Ancient Society." His views combine, in a great measure, the essential portions of the other hypotheses, and comprise a primitive community with promiscuity, the prevalence of a communal family, within which descent was connected through the mother, and a gradual development therefrom of social institutions through polygamy to monogamy, as we now see it in civilized peoples.

Nearly twenty years back our valued fellow member, the Rev. Lorimer Fison, took up in Australia the work commenced elsewhere by Dr. Morgan, and it was my privilege to join him somewhat later.

In Australia, if anywhere, one might expect to find primitive institutions preserved. The aborigines are in a low ethnic stage. They have been preserved until the settlement of their country by the white man through unknown periods almost wholly from contact with other races in a different stage of culture. Therefore, one might seek with good chances of success among them for, at the least, traces of the earlier form of the family and of society. One might further anticipate that evidence should be obtainable to show either a process of development of or degradation of the social status.

During the last fifteen years, Mr. Fison and myself have been diligently pursuing this line of inquiry against no ordinary difficulties, and with the result that our general conclusions have been received by leading anthropologists with favour. The results of our investigations, so far as regards the questions to which I have now directed attention, are as follows :—

(1) The social organisation of all the Australian tribes is based on the same general principles, with local and individual variations.

(2) The most primitive form of the family is a communal one, as evidenced by the existence in Central Australian tribes of that which we have called the Pirauru practice, under which a number of men, own or tribal brothers, cohabit in common with a number of women who are own or tribal sisters.

(3) Co-existent with the Pirauru practice in these tribes, there is also individual marriage, based upon infant betrothal, or exchange of women. In other tribes individual marriage predominates, with merely traces of group marriage.

(4) Society is organised upon the division of the community into two exogamous intermarrying groups.

(5) This division into two intermarrying groups, each of which is represented in a somewhat modified form by the Pirauru groups, brings into view a set of relationships which are those of group to group, and not those of individual to individual. But the individual takes the relationship of his group.

(6) The relationship terms in use are fundamentally such as would be required by such communal groups, but differ in different tribes in their departure from the primitive type. This departure is in the direction of a differentiation from general into special individual terms.

The general results of these enquiries are, that the earliest social organisation of the ancestors of the Australian aborigines was probably that of an undivided commune, or in other words, of the condition of promiscuity which has been postulated by some authors; the succeeding state was that of a divided commune, with promiscuity limited to each commune, and this still exists here. The Pirauru practice affords, in fact, an explanation of the existing system of polyandry in Thibet, and among the Nairs, on which Mr. McLennan's theory of the early state of society rests. He was, therefore, so far correct in assuming polyandry to have been an early social stage, but it was not as we now see, merely polyandry, but polyandry combined with polygyny—in other words regulated promiscuity, such as is now found existing in many of the Australian tribes.

The results thus attained have been reached by a series of stages, in each of which a certain advance was made upon previous hypotheses. This is indeed just that which one may observe in any of the sciences. Step by step data are accumulated as the horizon widens, and each advance establishes some part of the previous hypotheses, while it sweeps away those portions which have been based upon insufficient data.

Our present knowledge of the organisation of Australian tribes stands as I have sketched it. That this knowledge is still incomplete in many important details I readily admit,

but I must maintain that the general features have been sketched out in broad and sufficiently accurate lines, which will not be materially altered by further investigations. Details will be filled in and variations from the typical structure will be observed and recorded. It may be that some even more archaic form of aboriginal society will be discovered in tribes isolated in the desert parts of the western half of the continent. But I am satisfied it will be found that all information will fall into an orderly sequence of development from an undivided commune, with maternal descent, to a community in which individual marriage is completely established, together with a change of descent to the male life.

Such being the case, I may observe further, that in the varied series of social communities existing in Australian tribes, we may safely mark the gradual development of early society, which through savagery had led up, through the status of barbarism, to the present position of civilized man.

The work which still remains to be done in Australian Anthropology is immense, and includes investigations as to the racial affinities of our aborigines, including peculiarities or divergences of physical structure. Also whether, excluding the influence of other races on the northern coasts, there are or are not traces of the fusion in Australian tribes of two or more primitive races. It has long seemed to me possible that the aborigines of Tasmania may have represented the autochthonous inhabitants of the Australian continent, who had thus escaped by isolation from annihilation or absorption—annihilation by being killed by a superior and better armed people, and absorption of women as war captives. I am aware that a similar suggestion has been made by one of our most enlightened and efficient investigators, the Rev. W. Mathews.

Questions also as to the origin of the Australian aborigines also suggest the possibility of the occasional arrival in the northern, north-western, or north-eastern coasts of small numbers of persons of other races by stress of weather. The occurrence of paintings of a remarkable character in caves in Western Australia have been long a subject of discussion, but it seems now that the true explanation of their origin may be that given by Mr. Mathews at the late meeting of the Australasian Association for the Advancement of Science, and that the Australian aborigines are not to be held as being their authors.

The study of the Australian languages also requires immediate attention, not merely by the compilation of vocabularies or the partial study of some language by constructing a grammar. What is required, is the systematic study of one or more languages, by some thoroughly competent philologist, who not only possesses the necessary scientific qualifications, but who also has a thorough colloquial acquaintance with the language. Such a combination it will be most difficult to meet with, but no difficulties should be deterrent where such important results in a linguistic sense are to be obtained. The comparative study of the Australian languages, or rather dialects, for they are all certainly of one stock, should certainly throw some light upon the development of languages, although even, with so primitive a people as the Australian aborigines, we must be immeasurably distant from any indications of the origin of language itself.

There is still also a great field for enquiry into the folk lore of the tribes. I have found that the tales and fables told by the old people, in some cases clearly throw a light upon the past history of the tribe, or upon some part or other of its organisation which has died out.

The Deluge legends of the tribes of the south-east coast, point to the occurrence during their occupancy, of some of the oscillations of level, the results of which are patent to the geological observer.

It may even be, that the study of the folk lore may illumine the most obscure but most interesting subject—the origin of totems.

Numerous other subjects await further enquiry. For instance, the alleged or assumed powers of the native wizards or doctors, the knowledge of, and the practice by them of hypnotism, the secret ceremonies of initiation, the use of the gesture language, the knowledge of medical herbs and other remedies and practice of simple surgery, are all subjects which will bear further and exhaustive enquiry. A study of the songs of these aborigines would also prove a valuable contribution to the science of music, for comparison with the musical efforts of other early peoples. A study of the various implements and weapons used by Australian tribes would, I am confident, lead to interesting results bearing upon the development of appliances useful to man. For the Australian aborigines differ much among themselves in the perfection to which they have brought their imple-

ments, weapons, or the methods employed for catching game. I may point to the comparatively rude spears in some tribes, as contrasted with the highly-finished chalcidony spear points from North-western Australia.

I may here note in this connection, that materials for an exhaustive work on Australian stone implements, are being collected by Mr. R. Etheridge, jun., of Sydney.

In all the enquiries to which I have referred, the members of this section can aid either personally, where it is still possible to make enquiries from the aborigines, or by interesting persons living in other parts of Australia, where the aborigines are still numerous. Much most valuable information has been lost for ever, through the extinction of native tribes. The aborigines in all parts of Australia where settlement is in progress, are more or less rapidly dying out, and even where this is least apparent, the contact of the white man destroys the primitive structure of their society, and modifies their beliefs. Indeed, in all parts of Australia the native race is doomed to destruction sooner or later; contact with the white race is fatal; the aborigines lose the original savage virtue, and acquire instead our vices which destroy them.

It behoves us, therefore, as representing Anthropological science in Australia, to set earnestly to work to record all that can yet be learned as to the customs and beliefs, the arts of peace and war, of probably the most primitive race now existing of mankind.

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ART. IV.—*The Nomenclature of Chicken Embryos for Teaching Purposes.*

(With Plates 4, 5, 6 and 7.)

By PROFESSOR W. BALDWIN SPENCER, M.A.

[Read Thursday, May 8, 1890.]

The method of indicating stages in chicken embryos by the number of hours or days during which the egg has undergone incubation is unsatisfactory, inasmuch as different eggs incubated for the same length of time will be found frequently to contain embryos which have reached by no means similar stages of development.

A more satisfactory method is to give to the successive stages certain fixed and simple designations. This plan was adopted by Balfour in the nomenclature of elasmobranch embryos; and, for teaching purposes, the same system may be adopted with advantage in the case of chicken embryos.

The following indicates, briefly, a series which I have found convenient, and which is being adopted in connection with a students' manual now in course of publication. The stages are based upon the external form, and in this way the embryos may, as in the case of elasmobranch embryos, be classified without recourse to section-cutting, or the examination of the internal anatomy.

Each stage is indicated simply by a letter of the alphabet, and to avoid confusion, the letters *I* and *J* have been omitted.

*Stage A.*—This includes the early stages, commencing with the appearance of the first segmentation furrow in the germinal disc, and terminating in the formation of the blastoderm. This stage may be said to be passed through by the egg during its descent down the oviduct, and before incubation takes place.

*Stage B.*—The pellucid and opaque areas become defined, and in the hinder portion of the former, the "embryonic shield" is formed.



*Stage C.*—The primitive streak and primitive groove are formed, and at the close of the stage, the notochord can be seen passing forwards from the anterior end of the primitive streak.

*Stage D.*—The neural folds appear; they are widely separate posteriorly, and between them, below the middle of the neural groove, the notochord is clearly seen.

*Stage E.*—The first pair of mesoblastic somites appear.

*Stage F.*—Four pairs of mesoblastic somites are present.

*Stage G.*—Eight pairs of mesoblastic somites are present.

*Stage H.*—Fourteen pairs of mesoblastic somites are present. This is the last stage in which the long axis of the body of the embryo lies in a straight line.

*Stage K.*—Eighteen to twenty pairs of mesoblastic somites are present. The body of the embryo is just commencing to be curved at the anterior end. The auditory pits are widely open.

*Stage L.*—The first gill-cleft appears. Some twenty-four pairs of mesoblastic somites are present. The auditory pit is widely open. The heart lies to the side of the body, and has the form of a tube curved into an S shape. The amnion has grown backwards over the head, nearly to the level of the gill-cleft and the heart.

*Stage M.*—Three gill-clefts are present. The outline of the body becomes more clearly marked at the posterior end. The amnion encloses the whole head and neck region. The eye is prominent, and the choroid fissure large and well marked.

*Stage N.*—Four gill-clefts present. The amnion commences to grow forward from the posterior end, and the Wolffian ridge appears on either side.

*Stage O.*—Four gill-clefts present. The amnion almost completely encloses the body. The limbs appear as broad processes of the Wolffian ridge. On the ventral surface, the allantois appears as a somewhat hemispherical protuberance at the posterior end, and the tail is formed as a blunt curved process. The alimentary canal is nearly closed in.

*Stage P.*—The embryo lies completely on its left side, and is completely enclosed by the amnion. The allantois forms a prominent sac-like structure. The anterior and posterior limbs are prominent blunt protuberances. The

two olfactory pits are widely open, and a groove from each leads down to the mouth. The fronto-nasal process is not yet well marked.

*Stage Q.*—The gill-clefts are disappearing. The mid brain forms the most anterior and prominent part of the head. The limbs form prominent blunt processes, of which the anterior are the longer. There is no appearance of digits. The heart is enclosed within the body wall. The eye is deeply pigmented, and the choroid fissure prominent. The allantois stretches round to the dorsal surface. The body is curved, so that the posterior limbs almost touch the head in the region of the cerebral hemispheres. The fronto-nasal process is broad, and the olfactory pits widely open.

*Stage R.*—The gill-clefts have disappeared. The cerebral hemispheres have grown, and the mid brain is less prominent than in the previous stage. The eye is prominent, and the choroid fissure is not very distinct. The fronto-nasal process begins to be prominent when seen from the side. The anterior limb is curved, so that the proximal and distal halves form a sharp angle with each other, the elbow being thus indicated; the extremity of each limb is flattened out, but there is no clear indication of digits. The tail is clearly marked. The olfactory pits are slit-like, and the mouth much smaller than in the preceding stage.

*Stage S.*—The head has increased in size very markedly, relatively, to the rest of the body. The eye is very large, and the nictitating membrane appears as a fold. The fronto-nasal processes begins to be drawn out into a beak-like structure, and has almost, if not quite, united on either side with the maxillary process, leaving only the two external nares leading into the olfactory pits. The hind limb shows a well-marked bend, and is longer than the anterior. The anterior limb shows two blunt processes at its extremity, a larger and a smaller, and the posterior limb shows traces of four digits.

*Stage T.*—The rudiments of feathers appear in the form of a series of rows of knob-like processes on the head, back, ventral surface, tail, and the proximal part of the limbs. The beak is well marked, and has a small whitish knob on its upper surface. The anterior limb shows very clearly, at its extremity, a smaller and a larger process, the latter being divided into two digits. Four digits are very distinct in the posterior limb.

*Stage U.*—In the anterior limb the smaller process, indicating the first digit, is still very distinct. A special series of processes indicating feathers are developed along the post-axial border, and the third digit begins to become indistinguishable. The arm lies parallel to the long axis of the body, the forearm is bent forward at a sharp angle to this, and the manus projects at right angles to the long axis of the body. In the hind limb, the proximal part is covered with long processes indicating feathers, the middle portion with blunt processes, and the distal portion is developed into a definite foot.

*Stage V.*—The first digit loses its prominence, and the third one has almost disappeared. The whole is covered with developing feathers. In the hind limb, the middle as well as proximal portion is covered with hair-like processes, still longer than in the preceding stage.

*Stage W.*—In the anterior limb the first digit can only just be distinguished, and the limb has assumed a wing-like form. In the hind limb the divisions are bent at sharp angles upon one another, and the four digits have assumed very much the adult condition.

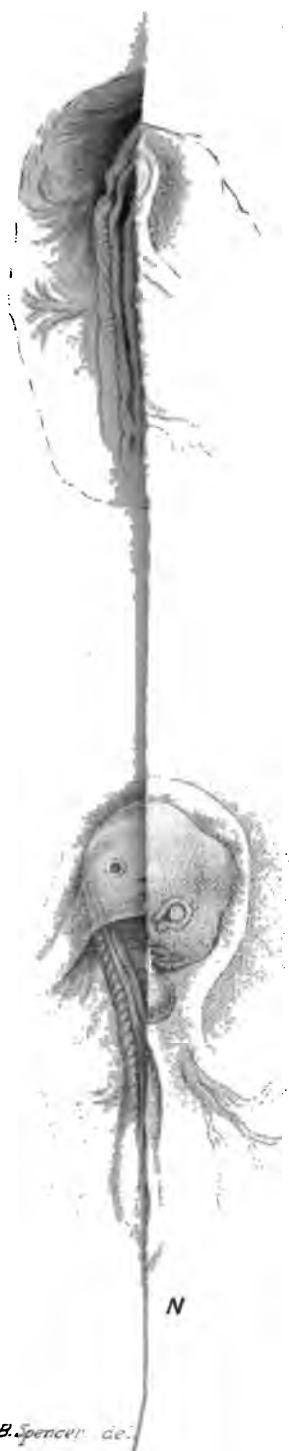
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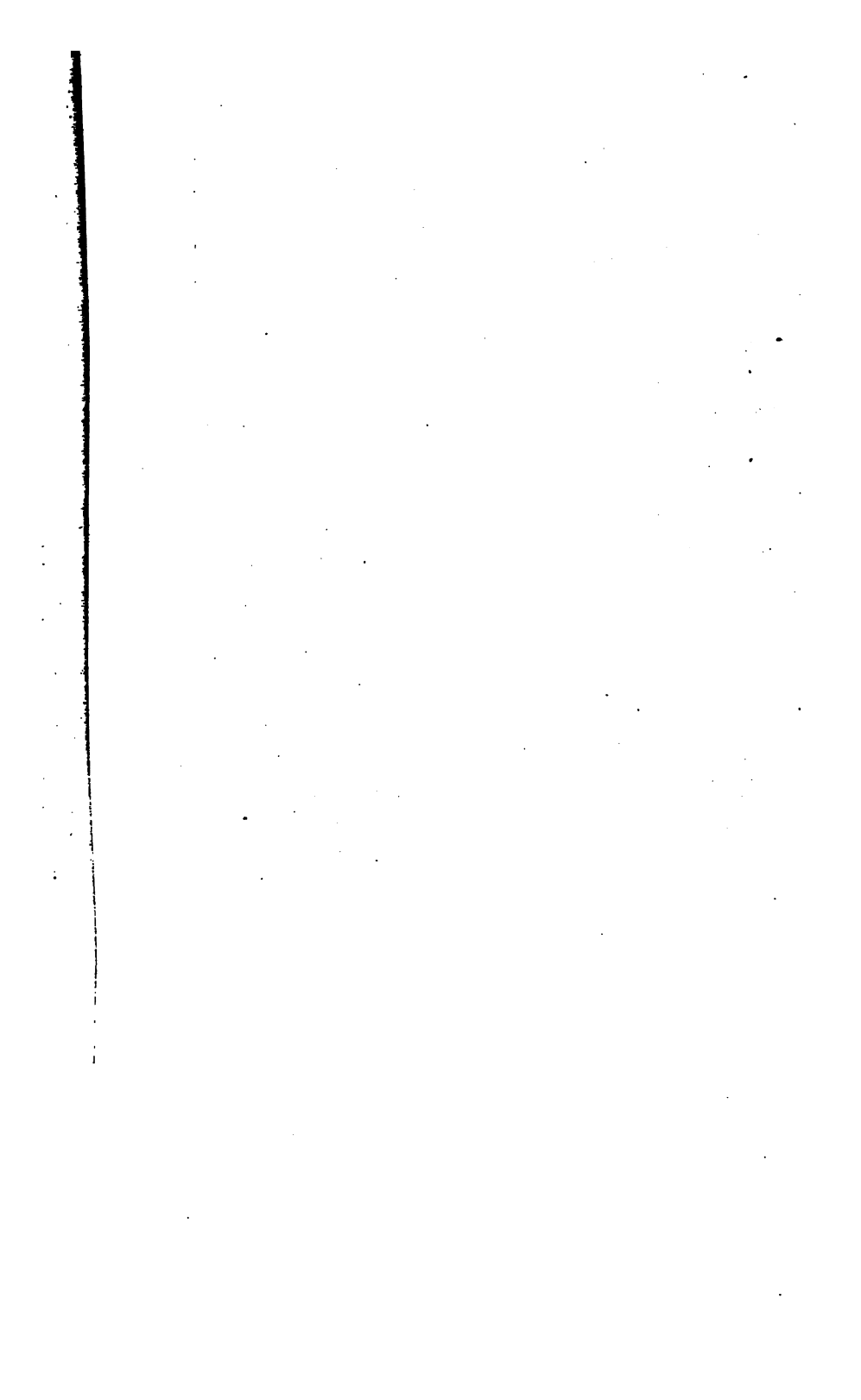


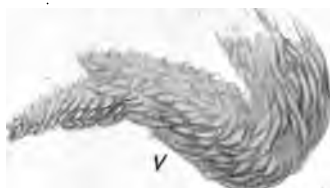
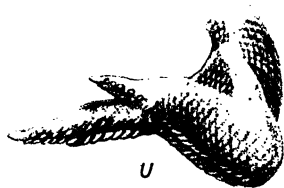
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ART. V.—*Observations on the Movements of the Heart  
of the Copper-head Snake (Hoplocephalus superbus,  
Günth.) in and out of the Body.*

By D. McALPINE, F.C.S.

[Read June 12, 1890.]

Having already carried out a series of observations on the movements, both of progression and pulsation, in the hearts of a few specimens from each of the five great divisions of the Vertebrata, and which were communicated to the Royal Society of Edinburgh last year, I thought it might also be of interest to members of this Society, to have the results in the same direction from a few more well-known native animals.

The two specimens of copper-head snake, which supply the material for the first portion of this paper, were captured at Oakleigh, on 21st April. The larger of the two was killed on the spot, by severing the spinal cord at its junction with the brain, and the other was taken home alive to be chloroformed. Since it is part of this investigation to see the effect of different modes of death, on the after-movements of the heart, I will describe separately and briefly these two cases. The heart is situated between  $\frac{1}{8}$  and  $\frac{1}{7}$  of the length of the body from the head end, and consists of two auricles and a ventricle, the single cavity of which is imperfectly divided by a septum. The first snake killed on the spot in the manner indicated was  $30\frac{1}{2}$  inches long when fully extended, and as Professor McCoy in his "Prodromus" gives the average as 5 ft or 6 ft. for this species, this one would be regarded as rather a small specimen. It was a male, like the other, and killed at 2.30 p.m. About  $5\frac{1}{2}$  hours afterwards, it was opened up from the ventral surface, and the heart was found beating steadily at an average rate of  $9\frac{1}{2}$  beats per minute, or 93 beats in 10 minutes. The heart was still within the pericardium, which was next removed, and the beats again observed. An average of 8 beats per minute

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was now recorded, or 81 in 10 minutes, ranging from as low as 5 beats per minute, when there were relatively long pauses, up to 11 in a minute. The movement was less regular without, than with the pericardium, and this is in keeping with what we know of the steady action of the pericardium and its contained fluid.

The heart was next excised about 6 hours after death (exactly at 8.39 p.m., or 34 minutes after the body was opened up). The auricles alone contracted for the first minute, then the ventricle began, but at a much slower rate than the auricles. Hence the ventricle and auricles did not contract in unison, but independently. The ventricle contracted at first at an average rate of  $4\frac{1}{2}$  times per minute, or 22 times in 5 minutes, while the auricles in the succeeding 5 minutes contracted 92 times, or on an average of  $18\frac{1}{2}$  times per minute. During the same period, the ventricle only contracted 18 times, or about one-fifth as often. The ventricle gradually began to beat at distant intervals, sometimes even of ten minutes, and finally ended with three beats at intervals of 1, 1, and  $\frac{1}{2}$  minutes respectively. The ventricular contraction entirely ceased  $23\frac{1}{2}$  minutes after excision. Meanwhile, the two auricles continued to beat as near as may be together, but the left auricle ceased about the same time as the ventricle. The right auricle still continued beating steadily at a rate of 8 beats per minute, then it gradually became enfeebled, and ceased to beat about 35 minutes after the left auricle.

Thus the ventricle and left auricle beat for about  $6\frac{1}{2}$  hours after somatic death, and the right auricle for about 7 hours, and almost exactly one hour after excision of the heart. For purposes of comparison, however, we will reckon the excised heart as a whole, and the pulsations would then cease with the ventricle, or  $23\frac{1}{2}$  minutes after excision. Both ventricle and auricles reacted to stimulation, such as the prick of a pin after spontaneous beating had ceased. The ventricle was found to do so for over 45 minutes, and the right auricle for about 15 minutes. The temperature of the room was pretty constant throughout at  $19^{\circ}\text{C}$ ., and the heart was simply laid out on a moistened plate.

The second and much smaller snake, measuring only 16 inches, was killed with chloroform. The effect of the chloroform was, that the snake coiled itself up and remained perfectly motionless, all but the tip of the tail. This moved to and fro for about 10 minutes, then quivered only,

and finally the snake was removed from the vessel with its mouth now gaping. The heart was first observed with the pericardium intact, and had an average of 39 beats per minute for the first 3 minutes. The pericardium was next slit up, and the heart exposed, and the average for 3 minutes was 23 beats per minute. The heart was now excised, 14 minutes after the removal of the snake from the chloroform. At first it beat very slowly, only about 8 per minute, then it increased after 20 minutes to an average of 31 beats per minute, and at the end of an hour it was beating at the average rate of 33 per minute. Throughout this period the beating was regular, that of the ventricle and two auricles alternating in regular succession.

When observed two hours after excision, the rate of beat of ventricle and auricles was very disproportionate. While the auricles beat in unison at an average rate of 27 per minute, the ventricle only averaged 9 beats per minute, or one-third that of auricles. Three hours after excision, the auricles averaged 22 beats per minute, and the ventricles only 6, or for 3 minutes in succession, 5, 6, and 7 beats respectively. Shortly afterwards the ventricle ceased to beat, a little over 3 hours after excision. In this instance there was no response to stimulation, at least 30 minutes after cessation of spontaneous beating.

The times of the principal events may now be given. Chloroform was administered at 11.27 a.m., snake taken out at 11.42 a.m., heart excised at 11.56 a.m., ventricle was seen beating feebly but fairly regular at 3 o'clock, p.m.; observed 20 minutes afterwards, and there was no sign of beating, even after watching for some time, so that the excised heart in this instance beat for at least 3 hours 4 minutes. Both auricles continued beating in unison, and 4 hours after excision the average number of beats per minute was 28, the left, however, feeble as compared with the right auricle. Five hours after excision, the average in both was 24 per minute; and 6 hours after excision, the average was 18 per minute, that of the left being now exceedingly feeble. Business here called me away, so that the final beating was not observed, but probably the left auricle ceased first, as in the preceding case. The temperature here varied from 18° to 23° C., slowly and steadily increasing from the former to the latter towards the end of the observation.

A third copper-head snake was obtained on the 14th May at Oakleigh. It was a very young one, only measuring

9 $\frac{1}{4}$  inches in length, and was killed with chloroform. Unlike the last, the mouth did not gape after death, but the sensitive tip of the tail trembled occasionally until the chloroform had taken fatal effect. This specimen was only removed from the influence of the chloroform after 34 minutes, and 4 minutes afterwards the heart was exposed. For about a minute no sign of movement was observed, then the beating commenced, and for 4 successive minutes the beats were 37, 46, 47, and 46 respectively. The pericardium was next removed as delicately as possible, and the beats fell to less than half the above, although only two minutes elapsed between the two records. The beating, however, was very regular, and for 3 successive minutes gave 21 per minute. The heart was now excised, and the beating at first was rather irregular. Two minutes after the last record the beats were 20 per minute, and for 10 minutes in succession, 36, 40, 15, 17, 25, 28, 30, 31, 32, and 33 respectively, or an average of about 29 beats per minute.

During the first three minutes after excision, a very interesting phenomenon presented itself. The heart travelled along the moistened plate in the direction of its base, and thus progression as well as pulsation exhibited itself. As I was always prepared for such a movement, the plate on which the heart was laid out had marks to indicate the slightest progress. The distance travelled happened to be the length of the heart itself, viz.  $\frac{5}{12}$  inch, and the rate of progression  $\frac{3}{12}$  inch the first minute,  $\frac{1}{12}$  inch each the second and third minutes.

There is something positively grotesque at first sight in an excised portion of the body, such as the heart, beating away and moving along at the same time, but I had become so familiar with this progressive movement in the excised heart of the frog, that it was to me not an unexpected occurrence.

In the excised beating heart, there is an exhibition of energy which is merely a continuation of the habitual work of the organ, but in the excised moving heart, there is a display of power for which we are unprepared. Just as in the detached gill, labial palp, or foot of the mussel, we might expect ciliary motion to continue, but not necessarily the progressive movement which they exhibit. The cause of this progressive movement in the latter case is evident, being due to the cilia; but how the excised heart is propelled, and why in the direction of base or apex, I leave to others

to determine. This much may be stated generally, that it will be the strong muscular contractions of the ventricular walls which will produce the movement. The fibres there are arranged spirally (at least in higher Mammals), and as each spiral contraction drives the blood forward when the heart is attached, so the force normally employed in doing so is now expended in sending forward towards the base the detached heart itself. The short and sharp contraction of the ventricle might be supposed to give a jerking action to the progressive movement of the heart, and as a matter of fact, in the frog's heart it was so; but here, the heart seemed to glide gently along, as if an intermittent source of energy was converted into a continuous movement.

There is likewise a deep interest attaching to such movement, not only as showing the abounding vitality possessed by the heart, even when out of the body, but as exhibiting in a very appreciable form the force and direction of the heart's energy. In the rabbit and kitten it is the same direction, but in the frog it is mostly the opposite, or apex-ward, and thus there is an important difference in the behaviour of the excised Amphibian heart, as against the Reptilian and Mammalian hearts. There is no occasion to enter into a detailed explanation of this fact now, but it may be noted in passing, that Drs. Waller and Reid\* state in connection with their electrical examination of the isolated heart, "all our observations support the theory, that the contraction proceeds from base to apex" in the frog, and "that the contraction begins at the apex and ends at the base of the ventricles" in the Mammals.

Resuming the record of the beats, this was as a rule taken every half-hour. The first half-hour after excision, three successive minutes gave 34, 35, 35 respectively, the beats being very regular and with vigorous stroke. The second half-hour the beating was still regular, but weaker, and 28 beats per minute for three minutes in succession were recorded. Fifteen minutes afterwards, 21 and 20 beats per minute were recorded. The third half-hour the beating was still fairly regular, and ran for five minutes in succession 20, 23, 22, 23, 23 respectively. The fourth half-hour the beating was steady, but feeble, and gave for 5 minutes in succession 17, 15, 16, 16, 16 respectively. The fifth half-hour showed very feeble beating, and a perceptible

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\* Phil. Trans., 1887, B. and Nature, Vol. xxxviii, 1888.

exhaustion of energy. In four successive minutes, 10, 12, 14, and 13 beats were recorded. Shortly after, the heart practically ceased to beat, although up to this the entire heart beat—ventricle and auricles—in regular alternation. Ten minutes after the last record there was no visible movement of the ventricle, although five minutes later the left portion of it showed very faint movement, but soon ceased. There were still very faint indications of movement at the junction of the auricles and ventricle, but we may say that the heart ceased to beat as a whole nearly three hours after the administration of chloroform, and two and a half hours after excision. The exact times were:—Chloroform administered 8.15; taken out 8.49; heart excised 9.5; last recorded beat of ventricle (13) at 11.38 and certainly still beating feebly at 11.40; so that the excised heart beat as a whole for 2 hours 35 minutes at least.

The contrast in the time of pulsation between this and the previous heart, is marked, both of which were taken from chloroformed snakes. The former with its auricles beating for 6 hours at least, and its ventricle for fully 3 hours, while the latter only pulsated altogether for about  $2\frac{1}{2}$  hours after excision. An explanation, however, lies in the fact, that a large portion of the heart's store of energy was used up in the progressive movement, for it was usually found in the frog's heart that the duration of pulsation was lessened when progressive movement occurred. The temperature was pretty constant throughout at  $20^{\circ}$  C.

Summing up the principal results obtained, they may be presented as in the following table, which gives only the maximum results in each case:—

TABLE I.

| Heart. | Mode of Death.       | In Pericardium.      | Without Pericardium. | Excised.             | Duration of Pulsation of Excised Heart. | Temp.                       |
|--------|----------------------|----------------------|----------------------|----------------------|-----------------------------------------|-----------------------------|
| No.    |                      | Per min.             | Per min.             | Per min.             | Hours. Minutes.                         | C.                          |
| 1      | Severing spinal cord | $9\frac{1}{2}$ beats | 9 beats              | $4\frac{1}{2}$ beats | — 23 $\frac{1}{2}$                      | $19^{\circ}$                |
| 2      | Chloroformed         | 39 „                 | 23 „                 | 33 „                 | 3 4<br>(at least)                       | $18^{\circ}$ – $23^{\circ}$ |
| 3      | Do.                  | 47 „                 | 21 „                 | 40 „                 | 2 35<br>(at least)                      | $20^{\circ}$                |

As regards the beats per minute, they vary considerably according to circumstances. The pulse-rate of the snake,

according to Colin,\* is 24 beats per minute, or according to Burdach,† 34 per minute, but from the above table, it is seen that this rate is exceeded when the heart of the chloroformed snake is observed, either attached and within its pericardium, or detached.

It may be mentioned that in the chloroformed snakes, the right auricle was distended with blood, while the left was flabby and empty. The explanation usually given, that the heart is distended after death by chloroform, owing to its want of power to contract, is negatived by these observations; for surely it will be conceded, that a heart which can execute movements and pulsate for hours, is not lacking in a considerable amount of stored up energy. But a probable explanation of the fact that the right side of the heart retains its blood, while the left side is deprived of it, lies in this, that the lungs (in this case lung) cease to perform their proper functions, that respiration is arrested, and so blood ceases to be received by the lungs through the pulmonary artery, or from them through the pulmonary veins, although the muscular, still living and active heart, continues to pulsate. And this suggests the question—Can a body be said to be dead entirely, while the heart within it is living and active? Death is the cessation of vital activity, but we cannot say that the progressing and pulsating heart does not exhibit activity of a vital kind, so that somatic death need not include cardiac death. Poets, novelists, and even scientists have spoken of the pulse of the heart being stilled by the gentle hand of death, but there may be death to all outward appearance, and still the heart beats—life at least cannot be said to be extinct. Professor MacAlister, of Cambridge, says‡ that stoppage of the heart and cessation of life are simultaneous in man and the higher warm-blooded animals, but I have observed the excised heart of a kitten to travel  $\frac{1}{2}$  inch forward and  $1\frac{1}{2}$  inch to right, and pulsate as a whole for 5 hours 12 minutes. It seems to me that death can only be accurately defined as stoppage of the heart's action, or rather, if this action be regarded as due to nerve substance, then the death of the nerves, or that part which co-ordinates, would be the final test. At present, however, in the Vertebrata at least, we may speak of partial or somatic death, and complete or cardiac death.

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\* See Landois and Stirling's Text-book of Physiology.

† Physiologie, Vol. iv, p. 25.

‡ Man, Physiologically Considered. Religious Tract Society.

I may briefly refer in conclusion to the results already obtained from the comparative study of the excised hearts of fish, frogs, reptiles, birds and mammals. As regards the movements of the heart, they are usually stated to be those of pulsation alone, but we have now to add progression and what I have ventured to call rhythmic quivering. This consists of a feeble quivering movement, after the regular visible beating has ceased, and which may last for a considerable time.

The following Table (II) gives the movements of pulsation and progression of excised hearts in the five classes of vertebrate animals, with the maximum result obtained in each case :—

TABLE II.

|                          | 1.<br>FISH<br>(Austra-<br>lian<br>Smooth<br>Hound) | 2.<br>FROG<br>(Green<br>and<br>Golden<br>Bell Frog) | 3.<br>TORTOISE<br>(Long-<br>necked<br>River<br>Tortoise) | 4.<br>COPPER-<br>HEAD<br>SNAKE<br>(Young) | 5.<br>BIRD<br>(Com-<br>mon<br>Fowl) | 6.<br>RABBIT<br>(Young)                                                          | 7.<br>KITTEN                                                                |
|--------------------------|----------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------|-------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
|                          | Min. Sec.                                          | Hours.                                              | Hrs. Min.                                                | Hrs. Min.                                 | Min. Sec.                           | Min. Sec.                                                                        | Hrs. Min.                                                                   |
| Duration of pulsation.   | 10 20                                              | 5 to 6<br>(at least)                                | 6 23                                                     | 3 4                                       | 1 15                                | 24 50                                                                            | 5 12                                                                        |
| Distance traversed       | —                                                  | 1½ in. in<br>2 min.                                 | —                                                        | $\frac{5}{12}$ in. in<br>3 min.           | —                                   | $\frac{5}{16}$ in. in<br>first few<br>minutes<br>(exact<br>time not<br>recorded) | $\frac{1}{2}$ in.<br>forward,<br>1½ in.<br>to right,<br>mainly<br>in 2 min. |
| Direction of progression | —                                                  | Apex, &<br>towards<br>left<br>usually               | —                                                        | Base—<br>straight<br>forward              | —                                   | Base,<br>with<br>slight in-<br>clination<br>to left                              | Base,<br>and to<br>right, ul-<br>timately<br>nearly<br>trans-<br>verse      |

In frog, snake, and kitten, chloroform was used as the means of death, so that these results are strictly comparable. Such investigations have evidently important bearings on all questions relating to the heart, and the nature of its action even within the living body. Incidentally, too, they throw important light on the effects of chloroform upon the heart's action. They show that when the breath is out of the body, the heart may be still beating away and capable of considerable exertion.

The now celebrated Hyderabad Chloroform Commission proved conclusively that, under chloroform, respiration ceased before the heart; for in the entire 571 animals experimented on, including dogs and monkeys particularly, and a few horses, goats, cats, and rabbits, this was invariably the case. Chloroform was, as a rule, administered very freely, and the maximum time the heart continued to beat after respiration ceased was 11 minutes in the dog, and 12 in the monkey. No doubt in the human subject, chloroform is not administered to the healthy, and the highly sensitive heart cannot long survive the death of the body; but making due allowances, the comparative study of excised hearts, justify and support the conclusions of that Committee, that death is not due to failure of the heart's action. And the record of cases of resuscitation, when surgeons have pronounced the patient dead, such as the one mentioned by a Surgeon-major of the Bengal Medical Service in the *Lancet* where he says, "I succeeded after about twenty minutes of the hardest work I ever had," enable us to indulge the hope that deaths from chloroform administered for medical purposes, will become rarer and rarer, especially with the young. The practical conclusion of the whole matter is, that while there is pulsation of the heart, there is hope.

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ART. VI.—On a Nematode found in the Stomach of a  
*Copper-head Snake.*

(With Plate VIII.)

By D. MCALPINE, F.C.S.

[Read June 12, 1890.]

This nematode was found in the stomach of the same snake as was infested with the fluke; it measured about five and a half inches in length, and was of a scarlet colour. Its presence in the stomach may be simply due to the fact that it was taken in with drinking water in the young condition, just as they sometimes enter the human body. Or, the eggs may have entered the alimentary canal through some intermediate host. It lived for several days in water freely exposed to the air, after which it was sent to my friend Dr. Cobb, of Sydney, for identification. He kindly supplied the accompanying drawings on which the following brief description is based :—

The specimen happened to be a female, and since many of the characters depend on the male, it has only provisionally been referred to the genus *Ascaris*.

The size and characteristic scarlet colour have already been mentioned. The body tapers towards each end, and is moderately stout (Fig. 1). The anterior end, of a whitish colour, is terminated by the mouth, which is surrounded by three projecting lips furnished with papillæ (Figs. 7 and 8). These lips are situated as shown in Fig. 6, one directed towards the dorsal surface and provided with two papillæ, and the two other lips sub-median, each with one papilla. The inner margins of the lips are tinged with scarlet, and the space between them is occupied by a shield-like organ (?) likewise coloured scarlet, which however is not shown in the Figure.

The posterior end of the body is rounded off, and near its extremity is the anus, a small transverse slit on the ventral

surface (Figs. 2 and 3). The lateral field is shown both here and near the middle of the body (Fig. 4), and it is seen to widen as the extremity is approached.

The nervous system consists of a ring surrounding the oesophagus, and giving off several nerves to the rest of the body (Fig. 5).

The female sexual apparatus is double, only one side being shown (Fig. 9). The ovary is disposed in longitudinal folds and occupies 37 per cent. of the length of the body. This is succeeded by a seminal receptacle, then a uterus in which eggs were found in the very first stages of segmentation and a vulva or sexual opening a little behind the centre of the body. The eggs are spherical, as shown in Fig. 10.

Finally, a formula is here given for this species, which will supply some necessary particulars for the future systematic placing of this worm.

The nematode formula devised by Dr. Cobb gives in brief compass the various measurements which are characteristic for any species, and indicates at the same time the general form and size of the sexual organs. The formula read from left to right, corresponds to the dimensions from head to tail; and the unit of measurement is not absolute but relative, the length of the worm itself being taken as the standard, and the measurements given in hundredth parts of that length. Thus each number expresses a percentage of the total length of the animal, adult specimens as they appear in profile being always taken. The formula consists of 11 numbers, representing as many dimensions. Ten of these numbers are arranged as fractions, the numerator denoting longitudinal measurements and the denominator giving diameters. The eleventh number at the end is the absolute length of the animal—the standard of measurement. The numbers are always given in the same order, referring to pharynx, nerve-ring, base of neck, vulva, and anus successively, so that the formula is brief yet clear, and comparison is easy with other species.

The formula for the present specimen may be given at first with explanatory names, and we will see how much information is compressed in these eleven numbers arranged in this particular way:—

|           |    | Pharynx. | Nerve-ring. | Base of Neck. | Vulva.           | Anus. |           |
|-----------|----|----------|-------------|---------------|------------------|-------|-----------|
| Lengths   | .. | ·1       | ·5          | 3·6           | 67 <sup>37</sup> | 99·75 | ·         |
| Diameters | .. | ·2       | ·3          | ·5            | 1·2              | ·4    | = 144 mm. |

In the first fraction, referring to the pharynx, the numerator (.1) denotes the distance from the anterior extremity to the base of the pharynx, or buccal cavity, and the denominator (.2) represents the diameter of the body at the base of the pharynx.

In the second fraction, relating to the nerve-ring, the numerator (.5) denotes the distance from the anterior extremity to the centre of the nerve-ring, while the denominator (.3) indicates the body diameter passing through the nerve-ring.

In the third fraction, referring to base of neck, the numerator (3.6) denotes the distance from the anterior extremity to the posterior end of the oesophagus, or base of the neck; or in other words, is the length of the head and neck combined. The denominator (.5) represents the diameter of the body at the point of junction of the oesophagus and intestine, or where the neck joins the body.

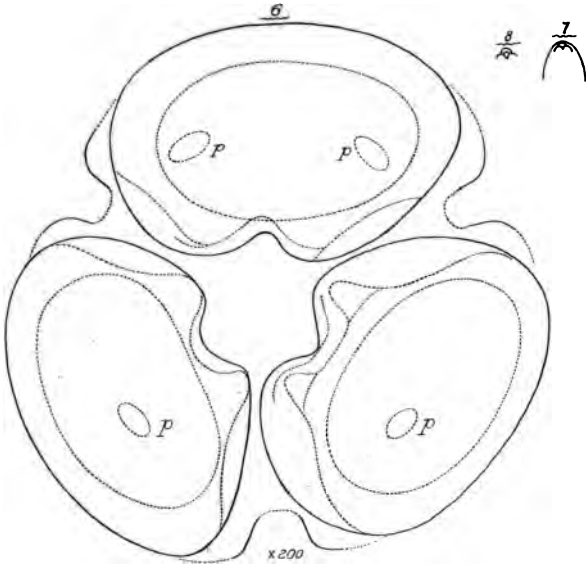
In the fourth fraction, relating to the vulva, the numerator (.67) denotes its distance from the anterior extremity, and the denominator (1.2) the diameter of the body there. A further reference is introduced here, placed above and to the right of the numerator, to indicate the percentage of the body occupied by the sexual organs. The number 37 indicates that they occupy 37 per cent. of the entire length of the body, or more than one-third.

In the fifth and last fraction, relating to the anus, the numerator (99.75) denotes its distance from the anterior extremity, and the denominator (.4) the diameter of the body there.

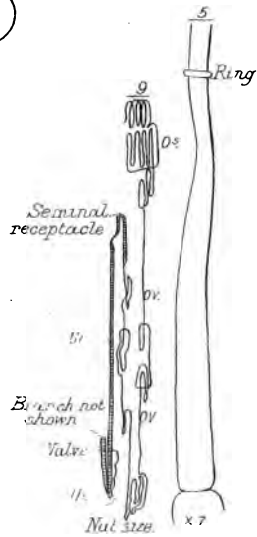
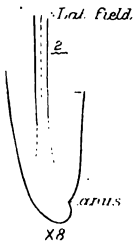
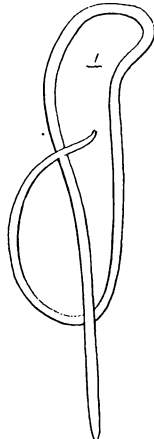
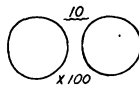
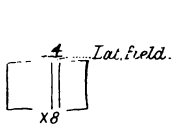
It must be clearly understood that relative dimensions and not absolute measurements are given, for relative and not absolute sizes are of prime importance for systematic purposes. However, if the actual measurements are desired, they may easily be calculated by dividing the body length, 144 mm. by 100, which gives the unit of length for the various parts. This unit is 1.44 mm., and the absolute lengths will be as follows :—

|                                   |    |    |         |          |
|-----------------------------------|----|----|---------|----------|
| Body length                       | .. | .. | 144 mm. |          |
| Length of head                    | .. | .. | ..      | .144 mm. |
| Length of neck                    | .. | .. | ..      | 5.040 "  |
| Length from base of neck to vulva | .. | .. | ..      | 91.296 " |
| Length from vulva to anus         | .. | .. | ..      | 47.160 " |
| Length of tail                    | .. | .. | ..      | .360 "   |
|                                   |    |    |         | <hr/>    |
|                                   |    |    |         | 144. mm. |





Formula  $\frac{1}{.2}$   $\frac{5}{.3}$   $\frac{3.6}{.5}$   $\frac{67.37}{1.2}$   $\frac{90.75}{4}$  144 mm



The continuous horizontal line of the formula may be regarded as the animal itself, the numerators indicating the dimensions in length at successive stages from the head end, and the denominators showing how the body thins, or thickens at each successive stage.

Summing up the information conveyed by the formula alone, we have a worm 144 mm. long, somewhat cylindrical in form, and from the base of the neck towards the anterior extremity there is a gradual tapering. In the posterior portion of the body, there is a very considerable tapering from the vulva to the anus, as indicated by the comparison of the figures 1, 2, and 4.

The numerators denote that the head is relatively small; that the nerve-ring is situated towards the anterior end of the neck; that the vulva does not occupy a central position in the body, but is situated in the posterior half; and that the anus is almost, but not quite, at the posterior end of the body.

Only one specimen having been met with, and the male unknown, it would be premature to fix the exact systematic position.

NOTE.—The nematode formula of Dr. Cobb is fully explained in *Ag. Gaz. N.S.W.*, vol. I, part I, p. 131.

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#### EXPLANATION OF PLATE.

All drawn with the camera, except ovary in Fig. 9, which is sketched in.

1. *Ascaris* sp. (?)
  2. „ profile, posterior extremity.
  3. „ ventral view of posterior extremity.
  4. „ near middle, showing width of lateral field.
  5. „ œsophagus and nerve-ring.
  6. „ lips and papillæ (p).
  - 7 and 8. „ lips.
  9. „ ♀ sexual organs, one branch only shown.
  10. „ eggs (spherical).
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ART. VII.—*Remarks on a Fluke Parasitic in the  
Copper-head Snake.*

By D. MCALPINE, F.C.S.

[Read June 12, 1890.]

While on a botanical excursion to Oakleigh on 19th April last, in connection with the Field Naturalists' Club, and under the leadership of Mr. French, Government Entomologist, this specimen of copper-head snake was met with and killed on the spot.

On dissecting it a few hours later, for the purpose of studying the beating heart, numerous flukes were found in it of a still undetermined species. Professor Baldwin Spencer\* gave a short account of a *Pentastomum* parasitic in the lung, before this Society, but I am not aware of any flukes having been hitherto recorded. In the lists of Ophidian Trematodes, as far as I am able to trace them, there is no mention of the copper-head snake as a host, so that the determination and description of this one will have to be given more fully afterwards. This fluke is apparently a common one, for on opening another copper-head snake, they were found to be abundant.

*Occurrence.*—They occupied the trachea and gullet in vast numbers, as well as the lung and anterior end of the stomach. Some of them were moving towards the mouth opening, and were thus free on the interior of the trachea or gullet, while others were adherent to the walls of these organs. A few were found in the mouth, evidently making their way out of the dead body.

It seems to be unusual to find flukes in both the alimentary and respiratory systems, as in none of the snakes to which I can find a reference is this the case. But here they are so numerous in both, that it is difficult to say

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\* Proc. Roy. Soc. Vic., Vol. I (New Series), 1889.

which is most frequented. They seemed to ordinary inspection quite black, and as many of them were at least a quarter of an inch in length, there was no difficulty in seeing the oral and ventral suckers.

*Habits.*—As the specimens were numerous and all alive, I had plenty of opportunities of observing their habits. They were seen to move along in the interior of the semi-transparent stomach at a comparatively rapid rate, by extending the body its full length, then fixing the head sucker and contracting to the fullest extent. In this way a continuous progressive movement was kept up. The same movement was seen on placing them in a little water in a watch glass, from which they tried to escape, and the amount of alternate expansion and contraction displayed was considerable. They also sometimes moved to and fro in the water. Usually when taken from the body and placed in a little water, or water and glycerine, they discharged the dark-brown ova in successive jerks sufficient to discolour the water or mixture. Almost invariably when taken direct from the body, and placed in water on a slide under the microscope, they were observed to jerk out the ova with considerable force, from an opening adjacent to, and immediately behind the oral sucker. In its force and suddenness, the discharge seemed like a display of fireworks. In some instances, the brown ova were so completely ejected, as to render the body white-looking to the naked eye, while in others only a very partial discharge took place. It is very instructive to observe the eggs passing out of the body in Indian file, and this can be done leisurely. I placed a specimen on a slide, and a cover-glass over it, so that when gently pressed, a constant stream of ova flowed out, quicker or slower, according to the pressure, and as long as desired.

The ova discharged so near the mouth orifice would frequently fill it, then they would be sucked in and suddenly thrown out and scattered in all directions. Another movement frequently observed under the microscope, was that of apparent feeding. Every now and again, what seemed a long neck-like portion of the body would be stretched forward and the mouth opened at the same time, then the body would contract and the mouth-opening close.

They assumed all sorts of shapes and proportions in moving to and fro, well seen as they moved about on a moistened slide. In water they could remain alive for some time, for several hours at least.

*General External Characters.*—The flattened body is, as already stated, sometimes over a quarter of an inch in length when fully extended, but varies from that down to one-eighth of an inch, an average size being three-sixteenths of an inch. The tapering anterior and posterior ends are whitish, and the bulk of the body is of a dark-brown, tinged with red, due to the ova principally. The anterior extremity is somewhat rounded, and has the oral sucker on its ventral face. The posterior end is marked by a distinct, projecting, tail-like appendage, flattened out and rounded posteriorly. It is usually protruded, but may be so retracted as to be entirely hidden underneath. The posterior or ventral sucker is generally relatively smaller than the oral, and with the dark back-ground of the body at this place, often stands out with great distinctness. It is situated somewhat behind the middle of the body.

The surface of the body is covered with spines, generally directed outwards or backwards, and sometimes larger than usual on portions of the head end. Towards the posterior end, they are arranged in transverse rows, and curved, with the concave side anterior. Towards the anterior end they seem to be arranged in oblique rows. Usually, in flattened-out mounted specimens, there are no indications of the spines, while in others similarly mounted they stand out with great clearness.

*Alimentary System.*—The mouth is situated in the muscular head sucker, not in the centre of it, but towards the anterior end. Its natural shape is roundish, but may be transversely oval in mounted specimens. It leads into a pharynx, which very soon enlarges into a thickened muscular body, succeeded by a comparatively short gullet, which is thin-walled. The gullet divides into two branches, right and left—the forked intestine—which pass along either side of the body, and terminate not far from its posterior end. The termination may be club-shaped, or even elongated oval, according to the amount of distension.

*Excretory System.*—In specimens rendered very transparent by caustic potash, the median tube of the excretory system may be seen towards the posterior end of the body, where the reproductive organs do not conceal it. It enlarges considerably here, then tapers to a fine tube which, towards the very end of the body, may be seen to break up into delicate branches.

*Reproductive System.*—This is rather complicated, as is usual in hermaphrodite animals.

*Male Organs.*—The testes are two roundish, or oval, conspicuous, compact, sac-like bodies, on the right and left sides of the body, each inside and slightly anterior to the club-shaped termination of the intestine. Leading from each is a *vas deferens*, both of which pass close together on one side of the ventral sucker, and immediately in front of it merge into the vesicula seminalis. This is an elongated body, extending in an oblique direction, nearly to the hinder part of the oral sucker, where it terminates in a relatively large transversely oval opening. Sometimes the anterior end is protruded, and a glairy-looking mass discharged from the mouth which sticks together.

*Female Organs.*—These organs collectively form the most prominent feature in the body. The ovary is situated behind the ventral sucker, and the uterus filled with its ova having reddish-brown shell-cases, gives its colour to the bulk of the body. About two-thirds of the length of the body is occupied by it, and it opens at the anterior end just behind the oral sucker, and alongside the termination of the vesicula seminalis. The yolk-glands form numerous dark-grey clusters on either side of the body, extending from a little in front of the ventral sucker to near the posterior end of the body. Their numerous branching ducts unite to form a main duct on either side, and there unite in the middle line. The shell-gland from which the uterus arises, is situated a short distance behind the ventral sucker in the median line. It is a globular glandular mass. The ova are of an elongated oval shape, and the shell opens by a lid.

Details will be given in a future communication.

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ART. VIII.—*Note from the Biological Laboratory of the University of Melbourne, on the presence of Corpuscles in the Liquid discharged from the Apertures of the Nephridia and Oral Papillæ of Peripatus.*

By ARTHUR DENDY, M. Sc., F.L.S.

[Read June 12, 1890.]

Recently, while staying with Mr. H. R. Hogg at Upper Macedon, I obtained about a dozen living specimens of *Peripatus*, both the Australian species, *leuckartii* and *insignis*, being represented. The specimens were required by me for anatomical and histological research, and were brought alive to the Biological Laboratory. Not having time to continue my observations at once, I endeavoured to discover the most satisfactory method of killing and preserving the animals for future use. I found that death could be caused instantaneously by holding the animal over chloroform contained in a bottle, without allowing it to come in contact with the liquid. In animals thus killed, I noticed at once a number of drops of a clear transparent liquid which made their appearance at the bases of the legs, in the position of the nephridial apertures, and gradually increased in size. It occurred to me to examine some of this liquid (taken from *P. leuckartii*) microscopically, and on so doing, I was surprised to find that it contained very numerous small amœboid corpuscles, resembling the white corpuscles of human blood, but perhaps a little more irregular in shape. These corpuscles measured not quite 0.015 mm. in diameter; some had numerous, short, slender pseudopodia protruding, some broader ones, and some exhibited a distinct nucleus. The liquid could only be obtained in small quantities, and soon dried up under examination; and, as I had killed nearly all my specimens and placed them in spirits before I began

to examine the liquid in question, I found I had not sufficient material for extended observations upon it. Seeing that the nephridia communicate directly with the body cavity, it seems to me most probable that the liquid containing corpuscles is really coelomic fluid, expelled from the body cavity through the nephridia under the influence of chloroform, the expulsion being probably due to sudden and strong muscular contraction. We cannot imagine that amoeboid corpuscles are a product of excretion, normally discharged from the nephridia, we must therefore believe that they belong properly to the coelomic fluid, although I am not aware that they have been hitherto observed in the coelomic fluid of *Peripatus*.

Prompted by these observations, I next, having now unfortunately only a single specimen (*P. insignis*) left alive, placed a drop of the liquid discharged from the oral papillæ of this animal under the microscope. This, also, I found to contain very numerous corpuscles nearly resembling those already described; but as this liquid very rapidly hardens into an enamel-like mass on exposure to the air, I had little opportunity of examining them in the fresh state. It seems probable, however, that these also are amoeboid, and since the slime glands do not (so far as is known) communicate with the body cavity, the corpuscles are probably formed within the glands themselves.

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ART. IX.—*The New Britain Currency, or Shell-money.*

By R. H. RICKARD.

(Communicated by REV. LORIMER FISON.)

[Read September 11, 1890.]

In this introductory paper I must take, almost without option, the Money, or Currency, of the islanders as my subject, for it is impossible to say much of these people without frequent reference to it.

The New Briton does not merely make money to live, which he must do or die, but he lives to make money. This is true not only of his fishing, planting, canoe-cutting, ornament-making, and of the various employments of his every-day life, but of his fighting and quarrelling, his witchcraft (both offensive and defensive), and of his very recreations—his feasts, his dances, and his secret associations or clubs. He can never get a wife without it, and to be buried without it is to become an evil spirit.

Many customs have their origin in it, *e.g.*, borrowing and lending, pawning, most of the charm-making, besides most of those above named. Hence it will readily be seen that it is necessary that we should know what this money is, before we speak on any of these subjects.

On the Gazelle Peninsula, which is the more important and more populated part of the island, it is called "tabu;" and on the Duke of York Islands, which are twenty miles away, it is called "diwara." It consists of small sea shells of the *Nassa* genus, which are about  $\frac{3}{8}$  inches in length, and proportionately thick. The back is chipped off so as to make an aperture through the shell. These shells are then strung or threaded closely and firmly in a uniform position on pared strips of cane, or a split vine, about the size of half of an ordinary straw. The latter is used only when the shell is new and the apertures rough and liable to catch on the fibres of the cane. In either case, it is first threaded on short pieces varying from twelve to twenty inches in length, and these are joined by splitting one end of one piece of the cane or vine, and pointing one end of another; the point

of the one is inserted into the split of the other, and shells drawn tightly over the other to hold it fast. In order to draw the shells tightly over the joint, the operator, as he sits, presses his heel on the opposite end of the piece which is split, and then draws the shells one by one towards him. When thus threaded and joined, it is measured off in fathoms and coiled. It is measured by stretching it from extended hand to hand across the chest, so as to make from five to six feet, according to the length of the man's arms. If it be a large quantity belonging to one person, it is generally put aside in coils of ten of these measurements called "pokono," and which for convenience the whites call "fathoms."

A peculiarity of this shell is, that it is not found in any of the localities where it is used as money, but only in a district on the North coast, known as Nakanai, and extending from one hundred to two hundred miles from here, and probably on to New Guinea. The natives gather the shells along the mangrove coast, to the roots of which trees they are found clinging; they collect them and tie them up in pandanus leaves, or the stipule of the betel palm, in sufficient quantities to make from three to six fathoms of "tabu." These parcels are exchanged to the natives of the Gazelle Peninsula for European trade—native ornaments or a kind of native money called "pele" which is made on Mioko, a small island of the Duke of York Group. This "pele" is made of pieces of white or lavender-coloured shell, drilled and strung on cocoanut fibre, then ground round to about the size of telegraph wire, and made up in lengths of from nine to twelve inches. At Nakanai, the "tabu" shells are used extensively for edging collars, armlets, anklets, and other ornaments; for making necklaces, head-dresses, and for ornamenting spears; but they sell much more than they use. The natives of the French Islands, which are nearly one hundred miles away to the North, are largely ornamented with these shells, which they obtain from Nakanai through trading expeditions. Some of these shell ornaments are found amongst the natives of the German Protectorate of New Guinea, but we cannot say whence they procure them. The shells when used for ornaments have more of the back chipped off than when used for "tabu," so as to make them flat; they have also two apertures to admit of being sewn on to ornaments. The natives of the Gazelle Peninsula also use a little of this kind of shell on collars and girdles.

When new, the "tabu" shell is of a dark colour, and strange as it may appear, the people on this side of the island, and on the Duke of York Islands, refuse to accept it as money. The coin new from the mint is repudiated in favour of the old and worn. However, we have not to look far for the explanation. The "tabu" comes from a great distance, and in the past, when communication was more difficult and less frequent than it is now, it was obtained here after it had passed from one person to another, from village to village, and from district to district, being probably years on the way, by which time it had become white, and until late years the people on the East Coast, and on Duke of York never saw the dark kind. The conservative nature of natives is not easily reconciled to anything which is different from that of their fathers. In fact, the most frequent and conclusive argument they use is "It was always so," implying "and it must always be so." White traders have tried in vain to whiten the new shell with chemicals. The "tabu" is worth much more here than it is at any of the places nearer its source, for passing through so many hands, it necessarily becomes dearer. If the traders could whiten the new shell, which they can buy cheaply at Nakanai, so as to pass it here, it would be very remunerative.

To witness the uses and advantages of the "tabu," let us first visit the market. This is either on the beach or on the boundary of two districts, at an appointed place, where the people of two or more small districts meet every third day to buy and sell. Here the women begin to assemble early in the morning, bringing with them burdens more suitable for horses than for human beings—baskets of taro, yam, or betel nut, coils of cane, and various other articles, which they carry on their backs, suspended by a strap passed over their heads. Those who arrive first sweep the grassless market-place, making it perfectly clean, for reasons which will appear in our paper on witchcraft. Soon the place is crowded with (in some instances) hundreds of men and women. The latter sit or squat down with their baskets, and spread out their taro or yams in sixes for sale. Their chatter is almost deafening, while they do a little trading among themselves. The men are standing about in little groups, some talking or joking boisterously, others speaking in a low voice, giving and receiving private commissions most secretly. Two old friends or business acquaintances meet, one of whom takes a bit of "tabu," about an inch

long, and containing eight shells, out of his basket, which he always carries under his arm, and turning to one of the women, buys a parcel containing four or five betel nuts and about a dozen pepper berries, then the friends have a social chew instead of "a social glass." Here are women buying six yams, or six taro, for a piece of "tabu" six inches in length, or forty shells. There is a man with a large fish and a string of small ones, he does not exchange them for yams or taro, but gets half a fathom for the former, and a quarter for the latter, then with part of it he buys his taro and a few parcels of betel nut, enough to last till next market-day, and returns home with the balance in his basket. Yonder is a woman selling lime in little bags of pandanus leaves sewn together, she gets eight shells for each bag. There is another selling eight ripe bananas for seven shells, and cooked taro for six shells each. Here is another selling puddings made of nuts and taro, or young taro leaves cooked in cocoanut milk, at the rate of seven shells per parcel. This man has bought a small packet of parrot feathers for dance decorations or fancy spears, and has given twenty shells for it. So we might note many similar transactions. A roll of cane for fish-trap making, for half a fathom; a fancy spear adorned with feathers, for three-quarters of a fathom. All this we have seen, but we have heard much more. One man pays a deposit on an unborn pig or dog. The beach-man hands his European trade over to a bushman to sell on commission, and the latter bargains with the former to sell his cassowary, or cockatoo, for a commission also. We hear them giving orders and making appointments. How strange it is to hear them calling ten shells five, and eight four, and so with all the numbers. Yes, but it is the custom with "tabu," but with "tabu" only. We hear the names for the various lengths of "tabu," viz., *a tip*, for any amount up to ten shells; *a tip na arip*, twenty shells; *a waratuk*, forty shells; *a bal*, eighty shells, or a quarter of a fathom; *a papara*, a half fathom; *a pokono*, a fathom; *a vuntu em tabu*, two fathoms; *a gaina*, three fathoms; *a arip*, ten fathoms. (These names vary in the different districts.)

Now let us go with a trading party from this town to a distant one. See what keen traders these people are. One has brought a stock of betel nut which he bought at the rate of eight shells, to sell again for twelve or eighteen. Another has bought a sucking pig for two fathoms, to sell

for four or five. This man has acquired print and tobacco for his cocoanuts, or his labour, and now comes here to turn them into money—the former for half its length in “tabu,” and the latter for its full length in “tabu.”

Next, let us follow the trading expedition to a more distant locality. The party numbers about thirty men in five canoes, and are armed with spears and slings, and possibly a rifle or two. The object of their trip is to turn larger articles into money. One buys a canoe for ten fathoms, to sell at home for twenty or more; another buys opossums' teeth for European trade, or at the rate of fifty or sixty shells per hundred, to sell at the rate of one and a half fathoms per hundred; another buys tortoise-shell with a little trade or “tabu,” with which to buy a supply of trade for his next expedition. Another buys a slave for four or five fathoms, and sells him; or her, for double the amount, or more; or perhaps the party has been successful in pouncing upon a few unsuspecting men, women, or children shell-fishing on the reef, whom they carry off as slaves. When we have added that a large pig is worth ten fathoms, a woman (for all wives are bought) from ten to thirty fathoms, and that whites readily buy the “tabu” at two shillings per fathom, we shall have a fair notion of its value.

When compared with other mediums of exchange, or of exchanging produce for produce, how convenient the “tabu” is! Compare a New Briton going to buy a wife with twenty fathoms doubled up in a basket under his arm, with the Banyai (Africa) mustering a little herd of cattle or goats, and driving them off to the home of his father-in-law elect. Or compare him with the Marshall Islander, whose money is a large rock with a hole through it, weighing upwards of half a ton, and which is put down near his house, and perhaps never removed, however often it may change owners. How conveniently and accurately divisible is the “tabu!” You may break it off at any length by holding it short and twisting it. It is capable of being lent and returned in exact quantities. It is neither liable to diminution by use, nor admits of counterfeit. It keeps its value because the supply is limited. It is a universal equivalent for all commodities, and everything that is capable of being transferred in commerce has a known money value, even the recently introduced European trade.

The great disadvantage of the "tabu" is its destructibility by fire, to which native houses are so liable. Recently several coils, probably amounting to a thousand fathoms, were destroyed in one house near our home.

It will be evident from what has been said, that the tendency of trade is to cut up the "tabu" into very small pieces. That which has been much used is full of joints, sometimes with only three or four inches between. This, and all the smaller pieces, are re-threaded on new cane, and all "tabu" that is put by is that which has been re-threaded. When a man finds that he has more than he needs for his ordinary business purposes, and enough to make a roll of one hundred or two hundred fathoms, he makes a hoop of cane with fern leaves twisted around it, to which several lengths of "tabu" are bound, and others added till a large coil is made. These coils vary in size from two to five feet in diameter, but the ordinary size is from two to three feet in diameter, and from eight to ten inches thick. These contain from one hundred to two hundred fathoms. They are most convenient in the event of fire or quarrels, the women quickly put their heads through them and run off with them. Persons making up large quantities of "tabu" have private marks, *e.g.*, one threads the claw of a crab, or part of a tentacle of a lobster, or a sea shell on every few fathoms; or instead of threading all the faces of the shells the same way, he threads a small piece here and there through the whole, with the shells face to face, or every second couple face to face. About the locality of our home, it is commonly believed that a certain chief, To Kaiya by name, has become wealthy through witchcraft. Thus, he puts aside shells enough to make up four or five fathoms, then with certain ceremonies, which of course he keeps secret, it increases to ten fathoms. These coils are wrapped up in pandanus leaves, or in the stipule of the betel-palm, or in banana leaves enclosed in nicely plaited cane.

There is an evident danger here, as in other countries, of money being locked up in the hands of the wealthy; but the danger here is greater, as these people have fewer wants, and can almost, if not quite, supply them all from their own plantations, or by the labour of their wives and menials. But there are certain customs, the principal purpose of which appears to be, to keep the money in circulation. To fully describe these would lead us within the scope of future papers, *e.g.*, marriage and funeral ceremonies, but it will be

sufficient for our present purpose to merely name them :—

(1) At every funeral, every man, woman, and child has a little given to them. If it be the funeral of a wealthy man, the amount given to chiefs is from two to three fathoms, to other adults a quarter to half a fathom, and to lads an eighth to a quarter. (2) All the women present at a birth get a little "tabu," according to the wealth of the father, from two to five fathoms. (3) A marriageable young man is caught, and held down while "tabu" is distributed to the spectators. (4) The poor man, who has been beggared to buy his wife, has a few fathoms given him by his wife's relatives, first for "house-warming," and afterwards at the birth of the first child. As we consider native customs, we shall see that a man is compelled by public opinion to give, if he has it to give, or can borrow it. Truly there is "nothing for nothing" in this country, but anything and everything for "tabu." It will buy a person out of any difficulty; an adulteress may buy her life for less than ten fathoms; a few fathoms will secure the death of an adult by secret murder, and less than that by witchcraft; and ten fathoms will make a whole tribe an ally in war.

There are no born chiefs here; money alone constitutes a chief, but of course, some are born wealthy, and in that way may be said to be born chiefs. Wealth is power. A young man borrows from a chief either for his marriage or his initiation into one of the clubs or secret societies, and until the debt with interest is paid he is a vassal to the chief, to run on messages, to dig his land, to paddle his canoe, or fight in his battles. A man who has plenty of "tabu" can buy soldiers by the tribe as long as it lasts. On state occasions it is exhibited, and for this purpose coils of "tabu" are hired for the occasion.

Two thousand fathoms may be said to constitute a millionaire, and these are not more numerous than in European countries. But wealthy misers are more numerous by far than among Europeans—men who are mean, and who live miserably, for no apparent purpose other than that of dying rich.

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**ART. X.**—*Notes on Miocene Strata at Jemmy's Point, with  
brief remarks upon the Older Tertiary at Bairnsdale.*

(With Diagram.)

By JOHN DENNANT, F.G.S., F.C.S.

[Read October 9, 1890.]

At various times, shells have been obtained at Jemmy's Point, but no particular attention was paid to them until a year or two ago, when Mr. Gregson, Land Officer at Bairnsdale, sent a number of species to Professor Tate for identification. Amongst many well known forms, of frequent occurrence in other portions of our tertiaries in Victoria, South Australia, and Tasmania, there were also several new species. The material forwarded indicated that the deposit probably belonged to the upper division of the tertiaries, but the determination of its exact position in the series required not only a fuller collection, but also a careful examination of the strata. It was, therefore, proposed by Professor Tate, when in Melbourne at the beginning of the year, that I should accompany him on a visit to Bairnsdale and Jemmy's Point; and with the welcome addition to our party of Messrs. Sayce and Pritchard, we succeeded in making an enjoyable, as well as a profitable, excursion to these localities. At the request of Professor Tate, I have undertaken to give the results of our researches.

I may say at the outset, that I do not pretend to discuss the general geology of the neighbourhood, our time having been fully taken up in collecting at the fossiliferous sections indicated to us by Mr. Gregson. Some interesting problems connected with the underlying and overlying strata presented themselves, but our stay was too brief to allow of their being fully studied, and they may well be left for local geologists to work out.

On the geological map of the colony, the Jemmy's Point beds are noted as of Miocene age, which is undoubtedly correct. The beds at Bairnsdale, however, are also given as Miocene, but as they are wholly distinct from those at Jemmy's Point, having scarcely a shell in common, it is difficult to see how they can belong to the same geological formation. In some remarks to be made later on, upon these beds, their relative position in the tertiary series will be considered.

On the accompanying locality map, the situation of those sections at Jemmy's Point, which we examined, is shewn. They are all on, or close to, the northern margin of the Reeves River, opposite Rigby, Fraser, and Flannagan Islands, and thus not far from the new Lakes' Entrance. An outcrop, three miles inland, is known to Mr. Gregson, but this we had not time to visit.

At "The Narrows," the fossiliferous strata crop out on the shore line, and extend for a few feet up the side of the bank. A section about three-quarters of a mile inland, on the line of a timber tramway near the Ti Tree Swamp, is slightly but not much higher, and at the horse shoe indentation, opposite Flannagan Island, the fossils were found from the margin of the river up to about forty or fifty feet on the bank.

These are all the outcrops we saw, but I think it highly probable that there are others, both along the shores of Reeves River from Lake King to Jemmy's Point, as well as for a short distance inland. At all the sections, except that at the Ti Tree Creek, blocks of flaggy sandstone were observed, either above or below the fossil beds; and what looked like the same strata shewed a good distance up, on the side of a hill between Jemmy's Point and Flannagan Islands. When in "The Narrows," I concluded that the fossils lay beneath the sandstone, but at the "Horse Shoe," the latter appeared to be inter-stratified with the fossiliferous deposit. I cannot, however, affirm that such is the case, as possibly the *apparent* superior position of the fossils in one part of the section may be otherwise explained.

The bank on the north side of Reeves River reaches to a height of from 150 to 300 feet, and is evidently the old coast line. The islands in the channel are flat and marshy, while the narrow strip of land, which alone separates the river from the ocean, consists principally of low sand dunes. The present coast features are, no doubt, due to the gradual

elevation of the land, the lakes and rivers, (or rather channels as they should be called) being simply formed by the banking back of the water by drift sand from the beach. At a period not very remote, the sea must certainly have washed the northern shore of Reeves River, and also the inland boundary of the Gippsland coast lakes.

The fossils are generally found in a light-colored calcareous sand, which in the "The Narrows" is mixed with clay at the bottom of the bank. In a few places, the shells form a whitish, friable limestone, in which it is rare to get a perfect specimen. Everywhere, indeed, though the shells are abundant, they are fragile, and it requires patience as well as labour to gather a good variety of species. Strong shells, such as *Pectunculus cainozoicus*, *Leda crassa*, *Trigonia howitti*, *Pellicaria coronata*, &c., are not only numerous, but also frequently perfect; the thin delicate shells are often broken, and a whole one, when found, is at once carefully packed in cotton wool as a prize by the collector.

In the following catalogue, the names and distribution of the fossils collected by our party at Jemmy's Point are supplied. The identifications are by Professor Tate, who has aided me in the palæontological portion of my task in the most liberal manner. Duplicates of all the new species are in his hands, and a description of them is to be published shortly.

The total number of species is 116, viz., Gasteropoda 59, Scaphopoda 1, Lamellibranchiata 47, Brachiopoda 1, Polyzoa 2, Cirripedia 2, Echinodermata 1, and Zoantharia 3.

| SPECIES FOUND IN JEMMY'S POINT BEDS. | Eocene                     |                                | Miocene.                   |               | PLIO-<br>CENE. | LOCALITY WHERE LIVING, AND REMARKS.      |
|--------------------------------------|----------------------------|--------------------------------|----------------------------|---------------|----------------|------------------------------------------|
|                                      | Lower Beds<br>Muddy Creek. | Schnapper Pt.<br>S. Australia. | Upper Beds<br>Muddy Creek. | S. Australia. |                |                                          |
| GASTEROPODA.                         |                            |                                |                            |               |                |                                          |
| Typhis sp. . . . .                   | ..                         | ..                             | ..                         | ..            | ..             | New species.                             |
| Cominella clelandi (Tate)            | ..                         | ..                             | ..                         | ..            | ..             | New species ( <i>aff. T. ovoidens</i> ). |
| Triton sp. . . . .                   | ..                         | ..                             | ..                         | ..            | ..             | ( <i>aff. F. rugata</i> ).               |
| Fusus gippslandicus (Tate)           | ..                         | ..                             | ..                         | ..            | ..             | New species.                             |
| Peristernia approximans (Tate)       | ..                         | ..                             | ..                         | ..            | ..             | Living in Temperate Australia.           |
| Fasciolaria sp. . . . .              | ..                         | ..                             | ..                         | ..            | ..             | New species ( <i>aff. V. undulata</i> ). |
| Eburnopsis sp. . . . .               | ..                         | ..                             | ..                         | ..            | ..             | New species.                             |
| Phos gregsoni (Tate)                 | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Nassa subirella (Tate)               | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Nassa crassigranosa (Tate)           | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Nassa labecula (Adams)               | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Voluta sp. . . . .                   | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Mitra englypha (Tate)                | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Mitra terebraformis (Tate)           | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Marginella tuberculosa (Tate) m.s.   | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Marginella crassidens (Tate) m.s.    | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Marginella bordeacea (Tate)          | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Oliva nymphaelis (Tate)              | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Ancillaria orycta (Tate)             | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Columbella simplex (Tate) m.s.       | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Cancellaria wannonensis (Tate)       | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Terebra subcatenifera (Tate)         | ..                         | ..                             | ..                         | ..            | ..             |                                          |
| Terebra sp. . . . .                  | ..                         | ..                             | ..                         | ..            | ..             | New species ( <i>aff. T. tristis</i> ).  |





| SPECIES FOUND IN JEMMY'S POINT BEDS.    | Eocene.    |               |               |            | Miocene.      |    | Plio-cene. | LOCALITY WHERE LIVING, AND REMARKS.                                       |
|-----------------------------------------|------------|---------------|---------------|------------|---------------|----|------------|---------------------------------------------------------------------------|
|                                         | Lower Beds | Schnapper Pt. | S. Australia. | Upper Beds | S. Australia. |    |            |                                                                           |
| LIAMELLIBRANCHIATA—Continued.           |            |               |               |            |               |    |            |                                                                           |
| <i>Corbula scaphoides</i> (Hinds)       | ..         | ..            | ..            | ..         | ..            | .. | ..         | Living South Australia, New South Wales, North Australia, East Indies.    |
| <i>Myadora corrugata</i> (Tate)         | ..         | ..            | ..            | ..         | ..            | .. | ..         | Living South Australia, Tasmania, Queensland, New Zealand.                |
| <i>Myadora brevis</i> (Sow.) ..         | ..         | ..            | ..            | ..         | ..            | .. | ..         | New species.                                                              |
| <i>Myadora praelonga</i> (Tate)         | ..         | ..            | ..            | ..         | ..            | .. | ..         | Living Southern Australia.                                                |
| <i>Myadora tenuirata</i> (Tate)         | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also Table Cape, Tasmania.                                         |
| <i>Myochama plana</i> (Tate) m.s.       | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also Table Cape, Tasmania.                                         |
| <i>Maetra hamiltonensis</i> (Tate)      | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also at Cheltenham.                                                |
| <i>Tellina aquilatera</i> (Tate)        | ..         | ..            | ..            | ..         | ..            | .. | ..         | New species.                                                              |
| <i>Tellina albimelloides</i> (Tate)     | ..         | ..            | ..            | ..         | ..            | .. | ..         | Living Southern Australia.                                                |
| <i>Tellina decussata</i> (Lam.)         | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also Table Cape, Tasmania.                                         |
| <i>Zenatiopsis angustata</i> (Tate)     | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also Table Cape, Tasmania.                                         |
| <i>Psammobia hamiltonensis</i> (Tate)   | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also Table Cape, Tasmania.                                         |
| <i>Chione propinqua</i> (T. Woods)      | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also Table Cape, Tasmania.                                         |
| <i>Chione subroborata</i> (Tate)        | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also at Cheltenham.                                                |
| <i>Chione lineolata</i> (Tate) m.s.     | ..         | ..            | ..            | ..         | ..            | .. | ..         | New species.                                                              |
| <i>Cytherea submultistriata</i> (Tate)  | ..         | ..            | ..            | ..         | ..            | .. | ..         | Living Chatham Islands, Fossil Pareora and Wanganui Systems, New Zealand. |
| <i>Cytherea paucirugata</i> (Tate)      | ..         | ..            | ..            | ..         | ..            | .. | ..         | Living Victoria, South Australia, New South Wales, New Zealand.           |
| <i>Dosinia grayii</i> (Zittel) ..       | ..         | ..            | ..            | ..         | ..            | .. | ..         | Fossil also Table Cape, Tasmania.                                         |
| <i>Chamostrea albida</i> (Lam.)         | ..         | ..            | ..            | ..         | ..            | .. | ..         | Living Southern Australia. Fossil Wanganui System, N.Z.                   |
| <i>Lucina quadrisulcata</i> (D'Orbigny) | ..         | ..            | ..            | ..         | ..            | .. | ..         |                                                                           |

| SPECIES FOUND IN JEMMY'S POINT BEDS.      | Eocene.    |               |               | Miocene.   | Pliocene.   | LOCALITY WHERE LIVING, AND REMARKS.                             |
|-------------------------------------------|------------|---------------|---------------|------------|-------------|-----------------------------------------------------------------|
|                                           | Lower Beds | Schnapper Pt. | S. Australia. | Upper Beds | Muddy Creek | S. Australia.                                                   |
| <i>LAMELLIBRANCHIATA—Continued.</i>       |            |               |               |            |             |                                                                 |
| <i>Kellia micans</i> (Tate)               | ..         | ..            | ..            | ..         | ..          | Fossil also Table Cape, Tasmania.                               |
| <i>Crassatella oblonga</i> (T. Woods)     | ..         | ..            | ..            | ..         | ..          | ( <i>aff.</i> <i>C. astartiformis</i> ).                        |
| <i>Crassatella</i> sp.                    | ..         | ..            | ..            | ..         | ..          | <i>var. C. spinulosa</i> , or new species.                      |
| <i>Cardita spinulosa</i> , (Tate)         | ..         | ..            | ..            | ..         | ..          | New species.                                                    |
| <i>Cardita</i> sp.                        | ..         | ..            | ..            | ..         | ..          | Living Bass Strait. Fossil also at Cheltenham.                  |
| <i>Cardita trigonalis</i> (Tate)          | ..         | ..            | ..            | ..         | ..          | Fossil also Table Cape, Tasmania.                               |
| <i>Cardita</i> sp.                        | ..         | ..            | ..            | ..         | ..          | Living Southern Australia and Queensland.                       |
| <i>Mytilicardia</i> sp.                   | ..         | ..            | ..            | ..         | ..          | ( <i>aff.</i> <i>L. woodsii</i> ).                              |
| <i>Trigonia howitti</i> (McCoy)           | ..         | ..            | ..            | ..         | ..          | Living Victoria, South Australia, Cape of Good Hope.            |
| <i>Trigonia acuticostata</i> (McCoy)      | ..         | ..            | ..            | ..         | ..          | New species.                                                    |
| <i>Nucula tumida</i> (T. Woods)           | ..         | ..            | ..            | ..         | ..          | Living South Australia, Tasmania, New South Wales, New Zealand. |
| <i>Leda crassa</i> (Hinds)                | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Leda vagans</i> (Tate)                 | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Leda</i> sp.                           | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Pectunculus cainozoicus</i> (T. Woods) | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Pectunculus subtrigonalis</i> (Tate)   | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Limopsis belcheri</i> (Ad. and R.)     | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Cucullaea curcioensis</i> (McCoy)      | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Pecten antiaustralis</i> (Tate)        | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Pecten subconvexus</i> (Tate)          | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Pecten meringae</i> (Tate) m.s.        | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Placunanomia iona</i> (Gray)           | ..         | ..            | ..            | ..         | ..          |                                                                 |
| <i>Ostrea arenicola</i> (Tate)            | ..         | ..            | ..            | ..         | ..          |                                                                 |



The species of six molluscs in the above list is doubtful, owing to the badly preserved state of the specimens, and the remarks which follow refer only to the remaining 110 species. The number of new species gathered by us was 24, which with 8 others previously discovered by Mr. Gregson, makes a total of 32 new species from these beds. Of the 110 species, 91 are extinct, and 19 are still living. In estimating the age of the deposit by the percentage system of Lyell, it is, of course, allowable to reckon only the Mollusca proper, and therefore, the 8 species at the bottom of the list will be neglected. We thus have 86 extinct, and 16 living species of Mollusca available for calculation. The following is a summary of their distribution in time:—

**EXTINCT SPECIES—**

|                                  |    |    |           |
|----------------------------------|----|----|-----------|
| Ranging from Eocene to Pliocene  | .. | .. | 3 species |
| „ Eocene to Miocene              | .. | .. | 12 „      |
| „ Miocene to Pliocene            | .. | .. | 2 „       |
| Recorded from Eocene strata only | .. | .. | 4 „       |
| „ Miocene „                      | .. | .. | 33 „      |
| Restricted to Jemmy's Point beds | .. | .. | 32 „      |

**LIVING SPECIES—**

|                                               |    |    |     |
|-----------------------------------------------|----|----|-----|
| Ranging from Eocene to present time           | .. | .. | 3 „ |
| „ Miocene „                                   | .. | .. | 8 „ |
| Restricted (as fossils) to Jemmy's Point beds | .. | .. | 5 „ |
| Total                                         |    |    | 102 |

The terms Eocene, Miocene, and Pliocene, are used merely to indicate the relative ages of our various tertiary deposits, as shown by the percentage of recent shells contained in them, and not to imply synchronism with strata so named in Europe. The percentage system of determining the horizon of a bed is, of course, as applicable to the Australian tertiaries as to those in other parts of the world. The Molluscan faunas of Schnapper Point, Jan Juc, Muddy Creek, and the Murray cliffs, are as rich as those from the Paris and Vienna basins, and will afford to the patient collector ample materials for their subdivision into well defined groups. The argument for the percentage method of classifying tertiary strata is very clearly stated by Professor Hutton in an article upon the Wanganui System of New Zealand, from which I quote the following remarks:—

“The value of taking the recent species of Mollusca in a tertiary rock, as a test of its relative age, has sometimes

been called in question. This has arisen, I think, from a misconception of the limits of the method. If it be true that species have gradually changed, or that they have been gradually introduced into an area—which no one doubts—then it must be true that, in each epoch, the nearer we approach to the present time, the nearer must be the resemblance between the fauna of the epoch and that of the present time. Indeed, the same holds good if, instead of assuming gradual change, we assume that the ancient fauna was altered by successive migrations into the area; for it is evident that the percentage test would be of great value here in ascertaining the relative ages of the various migrations; for each migration would bring many species similar to or allied to those now living, consequently the percentage system is of the greatest importance in testing the relative ages of any two sets of beds belonging to the same biological province. But it does not follow that this method can be trusted for correlating with accuracy sets of beds in widely distant areas. On the contrary, different districts have undergone different physical changes, and we have therefore every reason to suppose that alterations in floras and faunas would proceed with unequal rapidity in different parts of the world.”\*

It was stated above that out of 102 species of Mollusca in the Jemmy's Point beds, 16 are living, which is within a fraction of 16 per cent., and the beds may therefore be confidently referred to the Miocene period. Many more species will, I hope, yet be obtained from the strata; but, judging from the similarity of the gatherings by the members of our party, as well as by Mr. Gregson, this proportion is not likely to be materially altered.

Only one other deposit in Victoria has, so far, been definitely classed as Miocene, viz., the upper beds at Muddy Creek. In South Australia, the oyster beds of the Murray cliffs and elsewhere, are also referred to the same epoch. In both of these, the percentage of recent shells, as calculated from the described forms, is not more than half that given for the Jemmy's Point fossils; but with regard to the Muddy Creek fauna, when the work of naming all the species obtained is completed, the proportion will, I think, be slightly raised. The tertiaries of Australia are perhaps not

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\* “The Wanganui System,” by Captain F. W. Hutton, F.G.S., “Transactions New Zealand Institute” 1885.

sufficiently explored to enable us to make definite subdivisions of the principal groups, but from its high proportion of recent shells, the Jemmy's Point deposit is, undoubtedly, the youngest member of our marine Miocene group yet met with.

There is certainly a strong likeness between the Jemmy's Point and the upper Muddy Creek beds. Out of the 102 Molluscan forms gathered from the former, no less than 47 are found in the latter also. From the South Australian localities we get 10 additional species, making 56 per cent. of shells common to Jemmy's Point, and the other recognised Miocene beds.

In the lower or Eocene\* zone of Muddy Creek, which has yielded about 450 species of mollusca, only 16 of the Jemmy's Point fossils are found, and the majority of these are widely distributed shells, and common to the Eocene and Miocene throughout Australia.

At Muddy Creek, the Eocene and Miocene beds are in contact, a circumstance which prevented their distinct character being recognised until lately; but at Jemmy's Point it is of especial interest to note that the Miocene deposit is the only one present.

The Jemmy's Point beds are of course quite separate from the calcareous strata of the Glenelg River, Portland Bay, Jan Juc, Bairnsdale, &c., which are commonly, but I think erroneously, regarded as Miocene by our geologists. In an article read before the Australasian Association this year, I gave my reasons for placing these in the Lower Tertiary or Eocene group. They have been known as Miocene so long, and have been quoted as such in so many geological memoirs, both Australian and European, that it seems almost presumptuous to call in question the correctness of the classification.

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\* A confirmation of the opinion expressed by Professor Tate and myself as to the Eocene age of the lower Muddy Creek beds, and their equivalents in South Australia, has recently appeared from the pen of M. Cossman, a Parisian specialist in the Department of Tertiary Gastropods. In reviewing Parts I and II of Professor Tate's "Older Tertiary Gasteropoda," in *L'Annuaire de Geologie Universelle*, Paris 1889, M. Cossman says—"This fauna has an incontestable analogy with that of the Paris basin. M. Tate will probably give us this year a continuation of his grand work; we should see with pleasure this savant establish more frequent affinities with the European species, and with those of the Alabama basin. It is incontestable that the Australian fauna, if it does not contain species in common with these two faunas, occupies at the least a sort of middle place between these deposits, which are so widely separated geographically."

During the last ten or twelve years, however, the data necessary for determining the relative ages of our tertiary deposits have largely increased. An extensive suite of fossils has been collected, not only from the arenaceous and argillaceous, but also from the calcareous beds; added to which, some most important stratigraphical observations have been made on the sequence of the strata by Professor Tate and others. The conclusion to be drawn from the accumulated weight of evidence is, that the calcareous strata to which I have alluded must be referred to the Eocene, and not, as has hitherto been the case, to the Miocene epoch.

In the course of our trip to the Gippsland Lakes, we stayed for some hours at Bairnsdale, and took the opportunity of visiting the fossiliferous section on the banks of the River Mitchell, a few miles from the town. The fossils are contained in a hard calciferous rock, and are extracted with difficulty. During the time at our disposal, we were able to distinguish only twenty-three species, but I trust that, before long, some local geologist will recognise the fine opportunity there is here for collecting, and add largely to this number. I give a list of the fossils obtained, principally for the sake of comparison with those from the neighbouring bed at Jemmy's Point:—

Waldheimia garibaldiana.  
Waldheimia insolita.  
Waldheimia grandis.  
Waldheimia tateana.  
Magasella compta.  
Ostrea hyotis (?)  
Dimya dissimilis.  
Pecten gambierensis.  
Pecten sturtianus.  
Pecten semilævis.  
Hinnites corioensis.  
Lima bassii.

Lima jeffreysiana.  
Spondylus pseudoradula.  
Spondylus gæderopoides.  
Cucullæa corioensis.  
Conus (cast).  
Trochus (cast).  
Cellepora fossa.  
Clypeaster gippslandicus.  
Leiocidaris australis.  
Deltocyathus viola.  
Orbulina, sp.

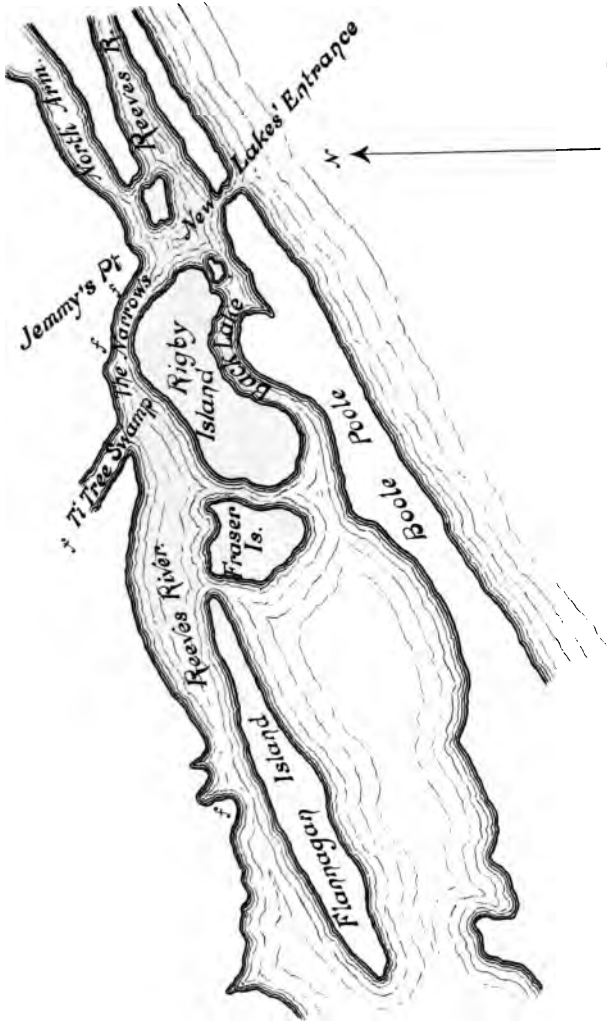
The only species common to this list, and that given for Jemmy's Point, is *Cucullæa corioensis* which, though most abundant in the Eocene, has yet been found in every part of the tertiary series, from Eocene to Pliocene. Possibly, with further research, a few other shells common to both deposits may occur, but, judging from my experience with similar strata in the west of the colony, the proportion will remain small.

On the other hand, sixteen out of the nineteen species, which are sufficiently well preserved to receive distinctive names, occur also in the Eocene blue clays of Muddy Creek,

the missing ones being *Pecten gambierensis*, *Hinnites corioensis*, and *Spondylus gæderopoides*. The last two, however, are recorded from equivalent strata in South Australia, while the remaining one is a common shell at Mt. Gambier, and in the Glenelg cliffs.

With such a small number of species, the percentage system of testing the age of the Bairnsdale deposit cannot, of course, be applied, but we are certainly on safe ground in classing it with those beds wherein all, or nearly all, its shells are represented, namely, with the Eocene of Muddy Creek and South Australia.

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*Map of portion of Reeves River, Gippsland Lakes.*  
*Scale:— 80 chains to an inch. f = Fossil Outcrop.*



ART. XI.—*Appendix to remarks on "The Older Tertiary  
Strata at Bairnsdale."*

By JOHN DENNANT, F.G.S., F.C.S.

[Read November 12, 1890.]

Since reading my notes last month on the North Gippsland tertiaries, I paid a short visit to Bairnsdale, and was fortunately able to see another section on the Mitchell River, about two miles higher up the stream than where we gathered the fossils last January. The locality had been previously visited by Mr. D. Clark, B.C.E., who kindly acted as guide on the occasion of my trip.

We drove along the south side of the river, and thence across the Lindenow Flats, till we came just opposite the house of a farmer named Skinner (Parish of Wuk Wuk). Having crossed the river in a boat, we found a fossiliferous bed exposed on the bank, extending from below water level to a height of about ten feet.

The strata consist of a light-coloured, friable, arenaceous rock, in which the shells are frequently well preserved. In the hard calciferous rock lower down the river, the fossils are for the most part casts only, and a perfect specimen is rare. The strata at Wuk Wuk reminded me of the calcareous bands at Muddy Creek, not only on account of the ease of working, but also because of the similarity of the fossils. Upwards of sixty species were obtained, the names of which are supplied in the following list. The species names of a few cannot be given, as although known from Muddy Creek and elsewhere, they have not yet been described :—

*Voluta mc'coyii* (juv.)  
*Ancillaria pseudaustralis*.  
*Pleurotoma haastii*  
*Cypræa murraviana*.  
*Trivia avellanoides*.  
*Natica polita*.

*Natica gibbosa*.  
*Turritella acricula*.  
*Turritella* (*aff.* *tristira*).  
*Turritella*, 3 species.  
*Siliquaria squamulifera*.  
*Eulima danæ*.

*Cerithiopsis* sp.  
*Trochus*, 2 species.  
*Minolia* sp.  
*Hemitoma ocellusa*.  
*Cylichna* sp.  
*Umbrella austrina*.  
*Entalis mantelli*.  
*Corbula* (? *pixidata*).  
*Myadora* sp.  
*Mactra howchiniana*.  
*Chione dimorphophylla*.  
*Cytherea eburnea*.  
*Chama lamellifera*.  
*Crassatella dennanti*.  
*Cardita delicatula*.  
*Mytilicardia compta*.  
*Leda vagans*.  
*Barbatia celleporacea*.  
*Barbatia simulans*.  
*Pectunculus cainozoicus*.  
*Pectunculus mc'coyii*.  
*Limopsis belcheri*.  
*Limopsis aurita*.  
*Macrodon cainozoicus*.  
*Modiolaria singularis*.

*Dimya dissimilis*.  
*Spondylus pseudoradula*.  
*Lima jeffreysiana*.  
*Lima bassii*.  
*Pecten murrayanus*.  
*Pecten foulcheri*.  
*Pecten zitteli*.  
*Ostrea* (? *hyotis*).  
*Waldheimia insolita*.  
*Waldheimia garibaldiana*.  
*Waldheima* sp.  
*Terebratulina scouleri*.  
*Cellepora fossa*.  
*Cellepora*, several species.  
*Salenaria*, 2 species.  
*Eupatagus* (? *murrayanus*) cast.  
*Echinolampus* sp.  
*Monostychia australis*.  
*Leiocidaris australis*.  
*Placotrochus deltoideus*.  
*Sphenotrochus excoisus*.  
*Isis* sp.  
*Biloculina depressa*.  
*Orbulina* sp.

An inspection of this list shows at once that, just as with the calciferous rock lower down the river, we are dealing with an Eocene, and not a Miocene, deposit. The two sets of strata are practically the same, the difference in the rocks being mainly one of sedimentation. Mr. Howitt, F.G.S., the well known and able geologist, in speaking of these deposits, says, "apparent alternations of hard and soft material arise, I believe, solely from variations of texture, due to local causes."\* The noticeable feature of the Wuk Wuk section, is that it yields so many more species than the calciferous rock close at hand, enabling us to determine with the utmost confidence, the particular epoch to which the Bairnsdale limestones belong. It will be remembered that on the Murray cliffs, the friable strata, rich in mollusca, merge gradually into the hard calciferous rock,† and that at Muddy Creek, the lower beds, with their profusion of fossils, either rest upon, or are bounded by, a similar rock.‡ On the Mitchell River, therefore, we have simply another illustration of the close connection, or rather identity, of the two sets of strata.

\* Progress Report, No. II, Geological Survey of Victoria, 1874, p. 62.

† Professor Tate, Proc. Roy. Soc. S.A., Vol. VII, p. 39.

‡ Proc. Roy. Soc. S.A., Vol. XI, p. 34.

The list of fossils given represents only a few hours' work by Mr. Clark and myself, but with perseverance, I have no doubt that quite a large collection might easily be made at Wuk Wuk.

Whether it may prove important economically to have our tertiary deposits exhaustively searched, I cannot say, but regarding the scientific value of the investigation, there can be no doubt. The history of Australia in tertiary times is of interest, not only to the geologist, but also to the student of botany, zoology, and other sciences; and in order that this may be fully understood, it is absolutely essential that the deposits known in different parts of the Continent should be referred to their proper horizon.

During the discussion on my paper last month, some questions were asked concerning the strata to the north of Bairnsdale and Jemmy's Point. The required information is contained in a general account, accompanied by a sketch map of the Mitchell River division, given by Mr. Howitt in Progress Reports, Nos. II and IV of the Geological Survey of Victoria, which should be consulted by anyone studying either the tertiary beds of the locality, or the more ancient strata underlying them. In those articles the Bairnsdale limestones are called Miocene, but I have given my reasons, both here and in previous papers, for altering this into Eocene, reserving the term Miocene for the Jemmy's Point beds.

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ART. XII.—*The Dukduk Association of New Britain.*

By R. H. RICKARD.

(Presented by REV. LORIMER FISON.)

[Read November 12, 1890.]

Dukduk is the name of a secret association on the Gazelle Peninsula of New Britain, and of the central figure in that association—a man dressed in leaves in imitation of a bird, which (*beo*, bird) it is frequently called. Probably the resemblance was stronger in the past than now, and the figure was in imitation of a cassowary, but the constant rivalry between the originators in the various villages has yearly produced many minor variations. The lower part of the dress is like a petticoat, made of long supple palm leaves, extending from the breast to, or a little below, the knees; around the body the leaves are fastened to a hoop of cane, to which are attached suspenders which pass over the shoulders. The upper part of the dress is a long conoid, the base of which is another hoop sufficiently wide to pass over the shoulders, and covered with more of the above-mentioned leaves, forming a long over-lapping fringe to hide the part where the two hoops meet, and rest one upon the other, and under which the arms are doubled up and hidden, while they hold the whole steady; and also frequently carry a spear projecting behind and before, while the hand is unseen. The part which hides the face is framed with cane, and covered with various things, as leaves, fibres, cloth, &c., worked together as only natives can work them. It is sufficiently open for the man to see his way, but not to admit of his face being seen by anyone a few yards distant. Above the head it forms a spire, often four or five feet long, on which the decorations are the best that native taste and

skill can produce. The whole dress is very bulky, being about three feet in diameter across the hips, and it is so heavy that the suspenders severely chafe the shoulders.

There are two species of this genus of birds—the one we have described with the long head-dress is the Dukduk proper, the other is a Tubuan. The latter differs in appearance from the former only in having a shorter, and consequently less beautiful, head-dress; but he is of inferior rank, and is the worker. The long spire of the former could not be worn inland, as it would constantly come in contact with the over-hanging limbs of trees, vines, &c. The work of the Tubuan is to fight, levy fines, lead in destroying property as a means of punishment, taboo fruit trees and plantations when hired to do so, and to make collections of food and “tabu” (native shell-money), either by stealing or begging.

I have spoken of the Tubuan as “he,” but the word means an old woman, and this Tubuan is held to be a female, and as a matter of course among natives is the worker. “She” is said to give birth to the Dukduks, and all Tubuans have female names, except in rare cases, as in one here, where “she” assumed the name of her deceased chief.

These birds and the association have their home, and conduct their business, on a piece of tabooed ground, called a tareu, a few acres in area, generally on the beach. It is taboo to all females and uninitiated males, who may not even pass it in canoes, except at a distance of a mile or two. Many Tubuans, owned by different parties, may have their home on the one tareu, but I cannot find that more than one Dukduk may. Here the dress is kept hung on a post, and appears exactly as when worn. There is always a large house on the tareu, which is the rendezvous for the members, where native politics, scandal, and gossip are discussed. Any member may don the dress, but only the young men do so as a rule; with this on, the young fellow trots, with long springing strides, up and down the beach, or takes an excursion into the bush, whooping all the way, and occasionally pronouncing his or “her” name. Some of the motions, especially those of the head, cannot do other than remind one of the cassowary. The women and uninitiated hide on his approach; if they do not, they are chased, pelted, or robbed by him. Through him or “her” alone does the society communicate with, or operate upon, the outside community. All the association’s acts are in the name of the

Tubuan or Dukduk. It often happens that a man, angry with his wife, wives, or female relations, dons the dress himself, and appears before them as the Tubuan to receive "tabu" to appease the angry person, or he may get someone else to do this for him.

The Dukduk is generally admitted to have originated at Cape Gazelle, and it has been suggested by natives that it was begun by thieves, who thus disguised themselves for plunder. Being found lucrative, it was adopted by others, and so spread from place to place, the privilege of being allowed to practise it being paid for. During our residence here, we have known a town to thus purchase it for several hundreds of fathoms of "tabu," the vendor initiating and instructing the purchaser; and in another case, where the purchaser did not conduct it properly, the neighbouring associations enforced a fine upon him. The irregularity in this case, was that of allowing women to cross a part of the tareu. A very old man tells me that it did not exist here when he was a boy, but others think he is mistaken, so the date of its origin is obscure. Its present object is certainly to acquire "tabu," while it affords general amusement, and provides liberal feasts for the members. The shell-money is got from initiatory fees, fines, and remuneration for tabooing fruit trees, &c., as a protection against thieving.

The association is worked thus:—It is started by a person or number of persons becoming members and purchasing the right from an existing one, which instructs the novices. These promotors receive all the profits, *i.e.*, the income minus the working expenses, as of feasts and workmen. Any male may become a member by paying the initiatory contribution, which is large or small, according to his means, or those of his relatives; it varies from ten to one hundred fathoms of "tabu." Candidates generally give as much as possible, in order to be well esteemed in society. There are generally a great many initiated at one time. They are introduced into the tareu by a member of the society, where a great many men are sitting around the clear space in the centre. On their entering, the Tubuan, to whom they are introduced before the Dukduk, smacks them with "her" hand or a stick, which is a signal for the spectators to rush upon them and assault them in the same way, so that they are often very severely treated, the juveniles excepted. Their friends then pay the contribution for initiation to the Tubuan, which varies from ten to twenty fathoms of shell-money; subsequently, they

are introduced to the Dukduk, when from ten to one hundred fathoms more are paid. Then they are set before a spread of the best food procurable, which has been prepared beforehand, and they are not allowed to leave the ground till it is finished, which is generally several days. During this time, they join with the others in all-night singing and dancing, and try on, and perhaps dance in, the Tubuan's dress. This contribution runs the young men into debt, and compels them to work with fish traps, or make plantations in order to obtain "tabu" to clear themselves. There are very few adult males who are not members of the Dukduk, while many boys as young as four or five years are members too, as their relatives fear their being fined for crossing some part of the tabooed ground, or for some precocious remark about the "bird," which would cost more than the initiation fees. This makes men of them, for the uninitiated are laughed at and spoken of as "women," and natives dread sarcasm more than spears.

These large societies in the past found plenty of employment, as they were really the Government in the various towns. Everything that was wrong in their eyes, gave them an opportunity to extort "tabu;" in this sense they were a terror to the doers of such evil as is condemned by native public opinion; but "might" with these natives is generally "right," so that the weak, especially the women, were the victims of their lust for gain. If a woman were known to have a little hoard, it was not difficult to devise an excuse for dispossessing her of it. Thus, I knew a woman who owned a small basket of shell-money; she was accused of the serious crime of laughing at a man in the presence of others which caused him shame; he, being a member of the Dukduk, mustered a party at night to go with the Tubuan to her home, and they took the whole of her wealth.

In petty cases, the Tubuan simply goes to the home and drives "her" spear into the ground, and squats beside it, perhaps to hide "her" legs, which might be recognised by some mark on them, till some shell-money is offered to "her," which, if not sufficient, "she" rejects by turning from it. If a member of the society is near, he goes to the Tubuan and ascertains "her" business. If only women are present, and cannot guess the reason for "her" visit, they send for a man, who is known to be a member, to come and ascertain, for a woman dare not attempt to speak to "her," or even to hint that communication by speech with "her" is possible. In

these cases the members speak to the Tubuan or Dukduk in a whisper. It is taboo for even members to speak aloud to them in public.

In more important cases, a large party, headed by the Tubuan, goes at night to the home of the delinquent, or to that of his more wealthy relative, for compensation. It is often a pretty sight to see perhaps a hundred men with torches wending their way up a hill, while all are whooping, and the Tubuan often interjecting "her" name. Their errand is generally known beforehand, and they are met with the "tabu." If it were refused, the man's house, if he himself escaped, would be torn to pieces or burned, in which case the Tubuan only would be said to have done it. Dreadful violence and license are allowed to the Dukduk or to its representative, the Tubuan. "She" may murder men or women with little or no excuse, and little or nothing is said about it, lest the secrecy of the institution be violated. Its decisions are the *vox populi*, and its strength is the "might" which among natives is undoubted "right." Hence the people fear it to such an extent, that they would rather suffer an unjust fine, than venture to incur its wrath. When the "tabu" is brought forth, it is scrambled for by the crowd; any which the Dukduk owners might get, they would claim in the name of the Tubuan; it is called "tabu na tabaran" (evil spirits' shell-money, *i.e.*, poor man's money).

The owners get fees for tabooing cocoanut trees or plantations, for obtaining fines on behalf of private parties, and for the Tubuan's presence on great occasions. The Dukduk's taboo is greatly valued, as people fear its wrath too much to run the risk of incurring it by stealing what it has prohibited. A great deal of the society's income is from fines for various reasons, *e.g.*, speaking disrespectfully of the "bird," as by implying the truth as to "her" person, by calling its dress "leaves" instead of "feathers," for speaking about it in the presence of women, &c. No one must hint that things are not what they are called, but of course the supposed secrecy is much greater than the real. Any excuse is availed of to fine non-members, *e.g.*, a lad here was fined three fathoms of shell-money for accidentally breaking a member's pipe, which might have been bought for a finger's length.

The Tubuan occasionally makes excursions in quest of fowls, fish, and puddings, for feasts on the tareu.

The N.W. monsoon is the fishing season, and in it most men and boys living near the beach are thus engaged, and in this way they accumulate more or less shell-money; so when it is near, the Dukduk and Tubuans are said to die. A few days before their death there is generally a public dance, in which the Dukduk and Tubuans take part; then there is a collection on their behalf, which is made by either spreading a cloth on the ground, or carrying it around among the people, and into it men and women throw their contributions of shell-money-pieces, varying from six inches to a yard in length. On the day of the death there is a feast on the tareu, when the dress is all burned, and there is pretended crying, which is all that outsiders know of the sad event. Collectors of curios have tried hard with tempting prices, to buy the head-dresses, but always in vain. Towards the close of the monsoon, when shell-money is more plentiful, these birds, phoenix-like, come to life again amid great ceremony and rejoicing among the members.

In all these things the proverbial proclivity of the native mind to prohibitions is very manifest. In the Dukduk it is taboo for men to have connection with their wives during its preparation, as also to eat food prepared by women, except that which requires but little handling, as whole taro or fowls; it is taboo to tie or fix in certain ways when making the dress, and other things too numerous to mention are "taboo." In various districts there may be slight differences in these and in other parts of the Dukduk. We have noticed on the North coast it is conducted with much less severity than on this side.

We have spoken of the Dukduk as it was a few years ago, but at the present time it is almost dormant, owing possibly in some degree to the influence of civilisation, but chiefly to the opposition of the whites. This has taken several forms—

- (1) That of ignoring their taboos, as by leading their servants or concubines with them, when walking the beach over the tareu. This greatly annoys the men, spoils their craft, makes them ashamed in the presence of their own women, and it demonstrates to the latter the falseness of the consequences which are said to result from it.

- (2) That of violence in cases where the Dukduk is the cause of war which interrupts the markets, or where it interferes with their boats, in the crews of which are some non-members visiting or landing at places near the tareu.

A short time ago the owner of a Dukduk was fined by the German Court two hundred fathoms of shell-money, for disturbing the peace of his district. Since then, a Manilla man in the employ of whites was killed by the Dukduk people while he was making a road through a tareu; this led to fighting, and severe consequences for the natives. Thus it has been checked, and it remains to be seen whether it will die altogether, or be conducted with moderation, and so continue more as an amusement than as a means of extortion.

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ART. XIII.—*Descriptions of New or Little-known Polyzoa.*

PART XIV.

By P. H. MACGILLIVRAY, M.A., M.R.C.S., F.L.S.

(With Plates IX and X.)

[Read November 12, 1890.]

MENIPEA PORTERI, MCG., Pl. IX, Fig. 1.

I have received, from the Rev. Mr. Porter, a single small specimen gathered at Port Jackson, New South Wales, differing in some respects from those from South Australia, described and figured in Transactions of the Royal Society of that Colony, Vol. XII, p. 25. In most of the zoecia, the fornix is wanting, and in others is small and clavate. The marginal spines are also thicker, and none are furcate.

EUTHYRIS WOOSTERI, n. sp., Pl. IX, Fig. 2.

Zoarium lobed. Zoecia alternate in longitudinal series, elongated, rounded above; separated by narrow raised lines; surface hyaline, convex; mouth lofty, arched above, contracted at the lower third, the lower lip slightly hollowed; peristome thickened, especially in the lower lip. A large avicularium on one side of the mouth, broad above, with the triangular mandible produced into an acuminate process directed downwards. Posterior surface indistinctly marked with longitudinal grooves, and thickly covered with very narrow, transverse, parallel rows of minute elevations.

Cooktown, Queensland, Mr. W. H. Wooster.

This beautiful species, which I dedicate to its discoverer, to whom I am indebted for many valuable specimens and much information, is readily distinguished by the form of the mouth, the large lateral avicularia, and the peculiar marking of the posterior surface of the zoarium. I do not

know the exact form or size of the zoarium, as the only specimen I have seen is the small lobe figured, part of Mr. Wooster's single specimen.

The genus *Euthyris* was proposed by Mr. Hincks (Ann. and Mag. Nat. Hist., August 1882), for a species from Western Australia, which he named *E. oblecta*. The essential difference between it and *Flustra* and *Carbasea*, consists in its having a perfectly formed oral aperture, with the opercular flap attached by a distinct hinge, in the same manner as *Thairapora*, McG., differs from *Membranipora*. He referred to the same genus, the Australian *Carbasea episcopalis*, Busk, and *Flustra bombycina*, of Ellis and Solander, from Bahama. The former undoubtedly belongs to the genus, as also probably does the latter, so far as can be determined from the brief description and imperfect figure given. The South African *Carbasea bombycina* of Busk (Brit. Mus. Cat. Pol., p. 52, Pl. XLVIII, Figs. 4 to 7), which is certainly not the species of Ellis and Solander, differs essentially in having a true zoecial pore, similar to that of *Microporella*, and has properly in the Challenger Polyzoa (Pt. I, p. 104) been subsequently made by Busk the type of a new genus—*Onchoporella*. In that work, Busk suggests that his species and *Microporella diadema*, McG., may be dimorphic conditions of the same species, an opinion for which I cannot see any justification. Independently of the difference of colonial growth, a point of comparatively little consequence, the structure and appearance of the individual zoecia are quite different. In *O. bombycina*, they are very slightly calcareous; there are several perforations on each side in addition to the zoecial pore, and there are no oral spines or avicularia. In *M. diadema*, the zoecia are broader, not so convex, in most forms highly calcified, and the avicularia are constant and very characteristic.

MEMBRANIPORA SEJUNCTA, n. sp., Pl. X, Fig. 5.

Zoecia oval or elliptical, disjunct, connected by tubes irregular in number and arrangement; margin thickened, with about six stout spines on each side, incurving over the front, and nearly meeting in the central line. Avicularia elliptical, with triangular mandibles, situated above the zoecia in the connecting network of tubes.

Port Phillip Heads, Mr. J. Bracebridge Wilson.

Allied to *M. pyrula*, Hincks, from which it differs in the much smaller size and connection of the zoecia by tubes, in the same manner as occurs in *Chorizopora*. The spines also are more slender; the first pair are usually nearly erect. The avicularia, moreover, are different, being round or oval bodies, situated above, and distinct from the zoecia in the network of tubes by which these are connected.

**BIFLUSTRA CORONATA**, Hincks' sp., Pl. IX, Fig. 3.

Zoecia large, quadrate; margins thick, strongly granular, sloping to the aperture, which occupies greater part of the area; the upper edge smooth and slightly raised. An avicularium above each zoecium, directed obliquely or transversely.

Western Australia, Mr. Wooster.

I have only seen a single specimen, growing along with *B. savartii*. It does not seem to differ from that described by Hincks in Ann. and Mag. Nat. Hist., February 1881, from Singapore or the Phillipines. It may be identical with *Membranipora cyclops*, Busk, which I only know from the description and figure in the British Museum Catalogue.

**BIFLUSTRA ACICULATA**, n. sp., Pl. IX, Fig. 5.

Zoecia large, elongated, distinct, slightly straighter above, rounded below; margin thick, bevelled inwards, covered with fine-pointed granulations, and with a row of close very fine sharp denticles projecting inwards from the edge of the aperture.

Port Jackson, New South Wales, Rev. Mr. Porter.

**BIFLUSTRA SAVARTII**, Audouin, Var., Pl. IX, Fig. 6.

Mr. Wooster has sent me some specimens from Western Australia, which I think must be referred to this species. The zoecia are angular, rather broad, distinctly separated; aperture oval or elliptical, occupying about two-thirds of the length of the cell, deep; a thick granular lamina slopes downwards to the aperture, the edge of which also is denticulate. In some of the specimens there are numerous small avicularia between the zoecia.

Waters refers *B. delicatula* of Busk, and the zoology of Victoria, to this species, but although closely allied, as previously pointed out by Smitt in the Floridan Bryozoa,

the zoecia in that form are very much larger and more regular, and I think that on the whole they ought to be retained as distinct species.

MICROPORA ABYSSICOLA, Smitt sp., Pl. IX, Fig 4.

Zoarium encrusting. Zoecia large, more or less hexagonal, much depressed, separated by raised granular margins; surface granular; aperture (fully formed) arched above, straight below or slightly bulging upwards, with thickened margins, entirely occupied by the operculum. Avicularian cells interspersed among the others, smaller, with the anterior extremity sharply pointed; in the centre, a large somewhat elliptical aperture, covered by a thin membrane, and having articulated at its anterior end a very long setiform mandible, part of which is fringed by a membranous expansion on both sides.

North Western Australia, on pearl shell, Mr. W. H. Wooster.

This has already been described by Hincks (Ann. and Mag. Nat. Hist., February 1881), from Cuba, and considered as the Membraniporidan form of Smitt's *Vincularia abyssicola* (Floridan Bryozoa), an indication which I think is correct. In my specimen, however, the front of the cells is more depressed and more granular than in Smitt's and Hincks' figures. Smitt also describes a thick ectocyst. In one of the zoecia, where calcification is not complete, it will be seen that the opercular flap is distinct in the inner membrane, which is exposed for a short distance downwards.

The genus *Vincularia* is one which, so far as I can see, ought not to be retained. It contains a heterogeneous collection, chiefly fossil, of species agreeing only in the erect cylindrical mode of growth. The majority of the species ought to be referred to *Membranipora* or *Biflustra*. Among the tertiary Polyzoa of Victoria, species of *Membranipora*, *Biflustra*, *Cribrilina*, *Schizoporella*, and *Lepralia*, are remarkable for occurring in the *Vincularia* form, and in fact form a striking feature of that fauna.

LEPRALIA LATERALIS, n. sp., Pl. X, Fig. 3.

Zoarium encrusting. Zoecia very large, distinct, ovate, convex, surface tubercular and pitted, except in a narrow space below the mouth; mouth lofty, arched above, contracted at the lower third, peristome thickened and

smooth, especially on the lower lip. Oecium very small, rounded, pitted and tubercular. A transverse avicularium, with narrow spatulate mandible pointed inwards, about the middle of the zoecium on one side.

Nichol Bay, North Western Australia, Mr. W. H. Wooster.

*LEPRALIA FEEGEENSIS*, Busk, Pl. X, Figs. 1, 3.

I have two specimens of this species sent by Mr. Wooster from Nichol Bay, North Western Australia, one on pearl shell, the other on coral. In both, the zoecia are very large, distinct, separated by grooves, slightly convex, and marked with numerous minute granulations and perforations. The mouth is large, coarctate. In the one on shell, there is in most of the zoecia, at each upper angle, a sessile avicularium, with a long pointed triangular mandible directed directly inwards above the mouth. There are several oecia which are large, rounded, prominent, and marked similarly to the zoecia. In the other specimen, the zoecia are more irregularly disposed, and differ considerably in size. Many have an avicularium on one side of the mouth, close to the angle of zoecium, with the mandible much shorter and broader than in the other specimen, and directed upwards. The projection on each side of the mouth is also rather sharper.

Busk (*Challenger Polyzoa*, Pt. I, p. 144, Pl. XXII, Fig 9), describes the zoecia as being "completely immersed so as to form an almost level surface, oblong and rectangular, disposed in linear series, surface smooth, and very finely and obscurely punctured." They are figured, however, as separated by well-marked grooves. He also describes the oecia as inapparent, but does not figure them, and he figures the avicularia as much more slender than in Mr. Wooster's specimens. Busk's specimen was probably younger, and I have no doubt as to the identity of the species. In addition to the Feegee's, it is also recorded from Hong Kong.

*SCHIZOPORELLA PULCHRA*, n. sp., Pl. IX, Fig. 7.

Zoarium encrusting. Zoecia irregularly arranged, ovate or elongated, convex, granular, separated by distinct raised lines; mouth lofty, a wide deep rounded sinus, separated by a sharp angle on either side; peristome thickened. Occasionally round avicularia, with semicircular mandibles, on separate areas.

SCHIZOPORELLA INSIGNIS, Hincks, Pl. IX, Fig. 8.

Zoecia ovate, distinct, hyaline; a row of elevated puncta (occasionally perforations), traversed by a continuous narrow line, enclosing an area on the front, and extending along the margin above the mouth; one or more similar marks on each side below the mouth; on the front of the cell, in the centre of the circumscribed area, is a small white elevation; mouth semicircular with a well-marked deep sinus in the lower lip, the entrance slightly narrowed. Oecia large, globose, whitish.

Port Wakefield, South Australia, Mr. T. Smeaton.

This, one of the most beautiful species of the genus, has been previously described by Mr. Hincks (Ann. and Mag. Nat. Hist. August 1881), from South Africa. The markings are very peculiar. They are lenticular, divided in halves by a continuous narrow thread-like line; they frequently become perforations. The Oecium has not previously been described or figured.

SMITTIA OBSCURA, n. sp., Pl. X, Fig. 4.

Zoecia confluent, indistinct, small, surface covered with perforations and tubercles; mouth with a denticle supporting an avicularium with a rounded mandible. Oecia globular, sub-immersed.

Lorne, Mr. W. H. Wooster.

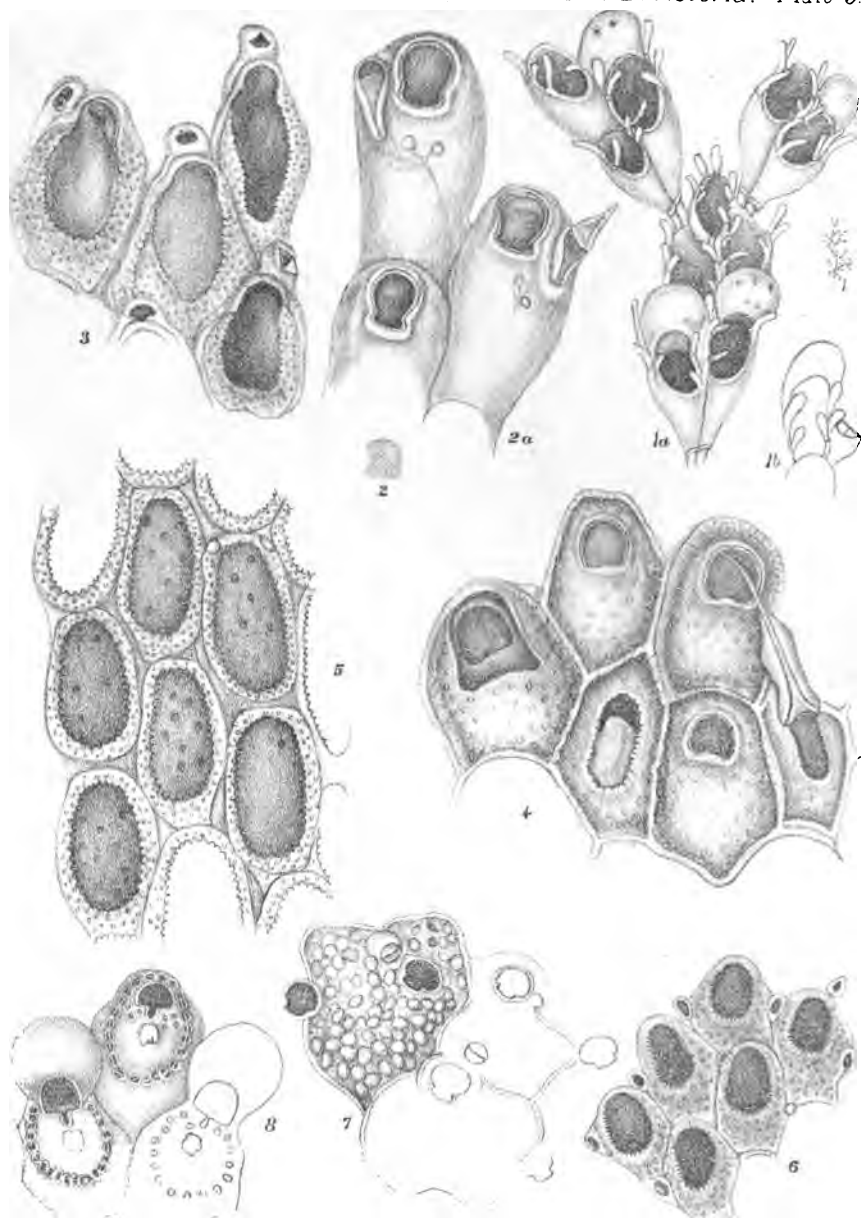
I have only seen a single very small specimen forming a little tube, which has evidently surrounded a sponge or small branch of seaweed. The zoecia are very indistinct; the surface occupied by round foramina, among which are interspersed calcareous nodules. These nodules are more abundant about the mouth, the form of which they obscure. A small avicularium can, however, be seen on a rounded denticle on the lower lip. The oecia are small, considerably immersed, without perforations or tubercles.

FASCICULIPORA LÆVIS, n. sp.

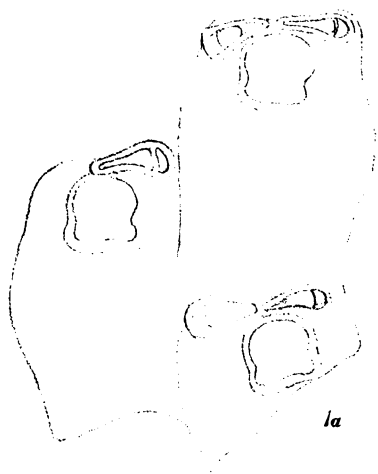
Zoecia very long, united in close bundles, or occasionally single; orifice dimidiate; surface smooth. Oecia bullate enlargements at the bases of the fasciculi; surface closely punctate.

Victoria, Rev. Mr. Porter.









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Of this, I have only seen a single specimen. It consists of a number of fasciculi springing from a common base. These fasciculi vary a good deal; some form closely packed bundles united up to their summits; others are arranged in double rows. A few zoecia are distinct almost from the base, and in these the orifice is mostly bilabiate.

## EXPLANATION OF FIGURES.

### PLATE IX.

- Fig. 1.—*Menipea porteri*, natural size.
- Fig. 1a.—Portion magnified.
- Fig. 1b.—Outline of zoecium and oecium, showing also avicularium.
- Fig. 2.—*Euthyris woosteri*, natural size.
- Fig. 2a.—Portion magnified.
- Fig. 3.—*Biflustra coronata*.
- Fig. 4.—*Micropora abyssicola*.
- Fig. 5.—*Biflustra aciculata*.
- Fig. 6.—*Biflustra savartii*.
- Fig. 7.—*Schizoporella pulchra*.
- Fig. 8.—*S. insignis*.

### PLATE X.

- Fig. 1.—*Lep. alia feegeensis*.
  - Fig. 1a.—Outline of part of same specimen.
  - Fig. 2.—Another specimen.
  - Fig. 3.—*L. lateralis*.
  - Fig. 4.—*Smittia obscura*.
  - Fig. 5.—*Membranipora sejuncta*.
  - Fig. 5a.—Avicularium, more highly magnified.
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ART. XIV.—*Notes on some Victorian Land Planarians.*

(With Plates XI and XII.)

By W. BALDWIN SPENCER, M.A.

Professor of Biology, University of Melbourne.

[Read December 11, 1890.]

The Planarians, with which this paper deals, were collected during the month of November by the members of a party from the Field Naturalists' Club of Victoria, which had gone out to collect in the country lying between Marysville and the source of the Yarra along the Wood's Point Road.

The country is heavily timbered, has numberless fallen logs, endless gullies, a considerable rainfall, and is eminently suited to planarian life. Certain forms were plentiful, and it may be noticed that these were principally the darker coloured ones, such as *Geoplana spenceri*, which, in parts, was found under almost every log turned over, and two new species to be hereafter described. There was a noticeable absence of the light-coloured species, in which the prevailing body colour is of a yellow tint. Such, in parts of Gippsland for example, are seen crawling about in the open, whilst not one was seen by us in this district of the comparatively common form *G. sugdeni*, and only few examples of *G. mediolineata* and *hogii*. The only light-coloured one at all common was *G. alba*, which showed numerous variations from the typical cream-white colour, the specimens varying from dark cream to a warm shade of brownish flesh-colour, sometimes being even more grey than brown. On only one occasion was a specimen seen crawling out in the open, and this was a *G. spenceri*, climbing a tree, and at a height of five feet from the ground.

Messrs. Fletcher and Hamilton for New South Wales, and Mr. Dendy for Victoria, have named the specimens as yet secured in the two colonies.

In his recent paper, Mr. Dendy\* enumerates fourteen species of *Geoplana*, and one of *Rhynchodemus*, as found in Victoria. Of these, our party secured seven species of *Geoplana*, or half the total number, and we were fortunate enough to discover two new species of the same genus, and one found in New South Wales, but not yet recorded in Victoria.

The following is the list of species found by us:—

1. *Geoplana alba* (Dendy).
2. *G. mediolineata* (Fletcher and Hamilton).
3. *G. mc'mahoni* (Dendy).
4. *G. hogii* (Dendy).
5. *G. munda* (Fletcher and Hamilton).
6. *G. sulphureus* (Fletcher and Hamilton).
7. *G. spenceri* (Dendy).
8. *G. dendyi* (sp. n.)
9. *G. walhalla* (Dendy).
10. *G. frosti*. (sp. n.)

The following is a brief outline of the chief points of interest, together with a description of the two new species:—

*Geoplana spenceri* (Dendy).—This was undoubtedly the most prevalent species, and seems to be characteristic of this part of Victoria. I found it for the first time under logs by the side of MacMahon's Creek, close to the Yarra; subsequently, Mr. Dendy found it in the same district, and again at Walhalla. Our collecting ground lay in a district intermediate between these two, and from the plentifulness of the worm, it is probable that we were near to the centre of its area of distribution. In regard to colour, there were considerable variations, some specimens having the typical dark, almost green-black dorsal surface, whilst others were of a decidedly lighter colour, varying from dark to very bluish-green, and at times with a slight indication of a median light stripe at the anterior extremity of the body. Though this is interesting as showing possibly a tendency towards *G. cerulea* in colour markings, there was never any difficulty in at once determining the species, and the examination of a far greater number of specimens than has yet been seen of this species, shows that it is a distinctly marked one.

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\* Transactions Royal Society of Victoria, Vol. II., p. 65.

This animal, together with the other planarians, is very destructive to insect life. It lives under logs with the curious little crustacean 'hopper,' and with various species of coleoptera and myriapoda, and the empty cases of these forms testify to its voracity. I have watched a *Geoplana spenceri* catch and eat a beetle; the latter inadvertently walked over the worm, and immediately stuck to its slime, then despite its wriggles, the planarian, with comparative speed, wrapped its body round the beetle which was soon enclosed in a slimy mess, and incapable of moving. Then the proboscis was inserted between the joints of the external skeleton, and the planarian fed at leisure.

*Geoplana mediolineuta* (Fig. 15).—Of this species, which is common in parts, we only found one specimen, despite the fact that between us we upturned hundreds of logs, and searched diligently beneath the bark of many gum trees. This species is very variable. In its typical form, it has a single median stripe, with indications at the extremities of the body of two lateral stripes. Sometimes, according to Mr. Dendy, these may be continuous along the body, sometimes they may be wanting, and even the median stripe but faintly present. In our specimen, the median and two lateral ones are well marked, and in addition, there are faint indications of two additional lateral stripes.

*Geoplana dendyi*, sp. n. (Figs. 1, 2, 3, 4, and 5).—Body long and narrow; greatest length when crawling, 6 inches; width,  $\frac{1}{4}$  inch. When living and at rest, triangular in section, with a prominent mid dorsal ridge (Fig. 1A), and always lies in the form of a coil. The opening into the pharyngeal chamber, in a spirit specimen measuring  $2\frac{1}{2}$  inches in length, was at  $1\frac{1}{2}$  inches from the anterior extremity. The genital aperture lies half way between the pharyngeal opening and the posterior extremity. Ground colour of the dorsal surface varies from dark to light green,\* and at the anterior extremity (Figs. 2 and 4) merges into blue, and this into the orange-coloured tip. Two very light yellow bands pass along the whole length of the dorsal surface, separated from each other by only a thin, but distinctly marked, line of dark body colour. The sides of the body dorsally are covered with light spots absent

\* In three fully grown specimens, unfortunately not preserved, the body colour was of a bright cerulean blue, and the same is true of one small young specimen. The two light stripes on the dorsal surface, and the triangular shape of the body, distinguish these from *G. cerulea*.

from a small band-like space on either side of the light lines (Fig. 3). The ventral surface varies in colour in dark specimens, being of the same green colour as the dorsal, with always larger or smaller patches of cerulean blue along the median line. In light-coloured ones, this (Fig. 5) colour may form a band along the greater part, or even the whole length, of the body, and may show indications of a median darker stripe in the mid ventral line.

This appears to be a very distinct species, and was found in considerable numbers under fallen logs, together with *G. spenceri*. It is the most abundant form along the ridge of high land separating the valleys of the Yarra from the Thompson River, and was only found in this district. Seen under the lens, the dark green or bluish skin, with its light dorsal bands and blue-white spots, is perhaps more beautiful than that of any other planarian, and I have much pleasure in naming the species after Mr. Dendy, who has already described some twelve species of Victorian land planarians.

*Geoplana frosti*, sp. n. (Figs. 6, 7, 8, and 9).—Body when at rest, flattened and leaf-like; when crawling, elongate and tapering equally at both ends. The opening into the peripharyngeal chamber, in a spirit specimen 1 inch long, lay slightly in front of the middle of the ventral surface. The genital aperture lay one quarter of the distance between the peripharyngeal opening and the posterior extremity. The dorsal surface is either dark brown (Fig. 6), or dark green (Fig. 7) in colour, in both cases with a bluish surface tinge, like the bloom of fruit, due probably to the enormous number of blue rod cells lying in the skin. Under the lens, the rods or groups of rods can be seen as fine points. The typical form has two light yellow stripes, separated from each other by a thin median dorsal line of body colour, running from the posterior extremity to the anterior orange tip. The ventral surface is light yellow in colour, though this is almost concealed by brown speckles absent along the median line, where is a well marked band of body colour, visible even in spirit specimens.

This species agrees with *G. dendyi* in its dark upper surface with two light stripes, but can be easily distinguished from the latter by its flattened form when at rest, and its light-coloured ventral surface.

One specimen found was remarkable for the slight development of the light stripes, which were only present at the posterior end, and were continuous with a slightly

lighter band along the median line, which gradually faded away anteriorly (Fig. 8). This specimen also was darker than the rest. It has a strong resemblance at first sight to *G. walhalla*, but the clear indication of the two light stripes dorsally, and the position of the genital opening, render it distinct from this species.

*G. frosti* was found only on the high land lying between the upper tributaries of the Yarra and the Thompson River, and even here was not very common; its distribution was practically identical with that of *G. dendyi*. It has been named after Mr. C. Frost, by whom the first specimen was found, and whom I have to thank for valuable assistance in various ways, both on this and on many other occasions.

*G. walhalla*, Dendy (Figs. 11, 12, and 13).—This has been already described by Mr. Dendy, who found it at Walhalla, not very far from the district in which we were collecting. It is somewhat leaf-like in shape when at rest, but in this respect forms an intermediate stage between *G. spenceri* on the one hand, and *G. frosti* on the other. When crawling, its upper surface closely resembles the former, from which, however, there is no difficulty whatever in distinguishing it, owing to its light-coloured undersurface, which is covered with brown speckles, as in *G. frosti*, though the median light stripe present in the latter, is here absent. This form and *G. frosti* are undoubtedly more closely allied to one another, than either is to *G. spenceri*, and it is figured here since Mr. Dendy was unable to represent it in the colours of life. Its distribution appears to be extremely limited. We only found one specimen, and this at the spot which we reached nearest to Walhalla.

*G. alba*, Dendy (Figs. 16 and 17).—This again has been described and figured by Mr. Dendy, and is represented here because the specimens found were of a notably dark colour for this species, to which, at the same time, they are undoubtedly referable. This belongs to the leaf-like forms (when at rest), and specimens vary in colour from almost white to orange, and sometimes brown and grey. The two figured were notable for showing a light median stripe, running the whole length of the body dorsally.

This form is widely distributed in Victoria, being recorded from the hill country extending from Macedon to the East of Mount Ellery, near the borders of New South Wales, in which, however, it has not as yet been found. It is the

most active and rapid in its movements of any planarian which I have yet seen.

*G. sulphureus*, Fletcher and Hamilton (Fig. 14).—This form has unfortunately not been figured by Messrs. Fletcher and Hamilton, but the description given by them of the colour, and the disposition of the bands, agrees so closely with this form, that it has been thought best to refer it to their species. They describe it as follows:—"Ground colour above and below of a uniformly bright gamboge yellow. In the median dorsal line, a narrow band of ground colour, bordered on either side by a dark reddish-brown line, as wide as the median stripe; external to each of them is a band of ground colour, as wide as the median stripe and its two dark bounding lines taken together; beyond which again, on either side, is an intensely black band, about as wide as the stripe of ground colour, which it bounds externally; the bands become more or less confluent just at the posterior extremity, while just anteriorly, they are obscured by the orange-red tint which colours the anterior extremity."

The specimen\* secured by us, agrees (Fig. 14) closely with this description, the outer dark bands being of a dark vandyke brown colour rather than black, and not so wide as those described above, and the ventral surface being somewhat lighter in colour than the dorsal.

This form, in all probability, comes near to *G. hogii*, as described by Mr. Dendy, but the absence of the broad greenish or greyish stripe, characteristic of the latter (typical examples of which we also found), serves to distinguish the two species.

It has not previously been recorded from Victoria, and now makes a total of four species known to be common to the two colonies.

Localities.—Mt. Wilson, Hartley Vale (N.S.W.); ridge between Thompson and Yarra Rivers (Victoria).

*Geoplana munda*†, Fletcher and Hamilton (Fig. 10).—This has been described by Messrs. Fletcher and Hamilton. The description which they give of its colours, does not exactly tally with the drawing (Fig. 8) given by them, and

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\* Since this specimen was described, my assistant, Mr. Mann, has secured two others from another locality, corresponding exactly in colour markings.

† Since the above was written, Mr. Dendy has described a large colony of this form, which he found under a log on the Dandenong Ranges, Victoria. He secured no less than fifty specimens from under this one log, all agreeing closely in colour markings.

from which the animal may be easily recognised. They say, "undersurface greyish in centre, yellowish towards the margins. Above these is a narrow median dorsal line of pale olive brown, bounded on either side by a very fine dark line, external to which is a broader band of a slightly darker brown, and this is boarded externally by a very dark brown line, which gradually merges into a rather broad band of very dark brown, which fades gradually towards its outer margin."

In Fig. 10, the animal is represented for the first time in the colours of life, and may be described as follows:—The body colour is yellow (the tint being that known as Naples yellow), varying in intensity in different specimens, and being always lighter on the ventral than the dorsal surface. On the dorsal surface are, typically, four darker bands of colour. Two of these lie one on either side of the median line, enclosing between them a narrow strip of body colour; their internal edges are sharply marked, their external ones are less defined. External to the dark lines is a band of body colour, some three times the width of the median stripe, and covered with speckles of brown, which seem to spread out from the dark bands above mentioned, and to gradually diminish in number towards the external borders. External to these light bands lies, on either side, a dark brown band, somewhat wider than the former. Each may be divided into three portions—an upper, median, and lower. The upper has its internal edge sharply marked, and is always very dark; it passes more or less abruptly into the median part, which has a characteristic speckled appearance, and is bounded externally by the third and lower portion, made up of a somewhat narrow series of dark brown speckles. This lowest part varies somewhat in definition. The four dark bands are always present, but in addition to these, there may be present on either side, just where the dorsal merges into the ventral surface, a linear row of brown speckles, tending to form a dark line along each side. The brown of the bands varies from vandyke to umber.

It is of interest to note that the land planarians, so far as yet known in Victoria, may, with regard to colour markings, be clearly divided into three main groups. The first of these is characterised by a uniform light tint all over the body, varying in different localities from white to orange, or a warm shade of grey. This is represented by the common form *G. alba*, which is found apparently in all parts of

Victoria, having the widest distribution of the known forms. Possibly, from a form similar to it, the others have been derived.

The second group contains the dark-coloured varieties, in which the upper surface of the body is characterised by its dark colour—either blue, green, or brown. This may again be subdivided into two groups, one of which has a dark, and the other a light-coloured ventral surface.

The third group contains the light-coloured varieties marked dorsally by dark stripes. This again can be conveniently subdivided into two groups, the one of which has a median, and hence an odd number of dark stripes; the other having a median light line of body colour, and hence an even number of dark stripes.

The various forms yet known can hence be tabulated conveniently as follows :—

(a) Uniform light tint on upper and lower surface, no dark stripes.

*G. alba.*

(b) Dark tint (blue, green, or brown) on upper surface.

(1) Dark ventral surface—

*G. cerulea.*

*G. spenceri.*

*G. dendyi.*

(2) Light ventral surface—

*G. walhallæ.*

*G. frosti.*

(c) Light tint (shade of yellow) on upper surface.

(1) Even number of dark stripes—

*G. munda.*

*G. mc'mahoni.*

*G. hogii.*

*G. sulphureus.*

(2) Odd number of dark stripes—

*G. mediolineata.*

*G. quinquelineata.*

*G. adæ.*

*G. lucasi.*

*G. sugdeni.*

*G. quadrangulata.*

*G. fletcheri.*

It remains to be seen whether the internal anatomy will reveal any corresponding relationship amongst the various forms.

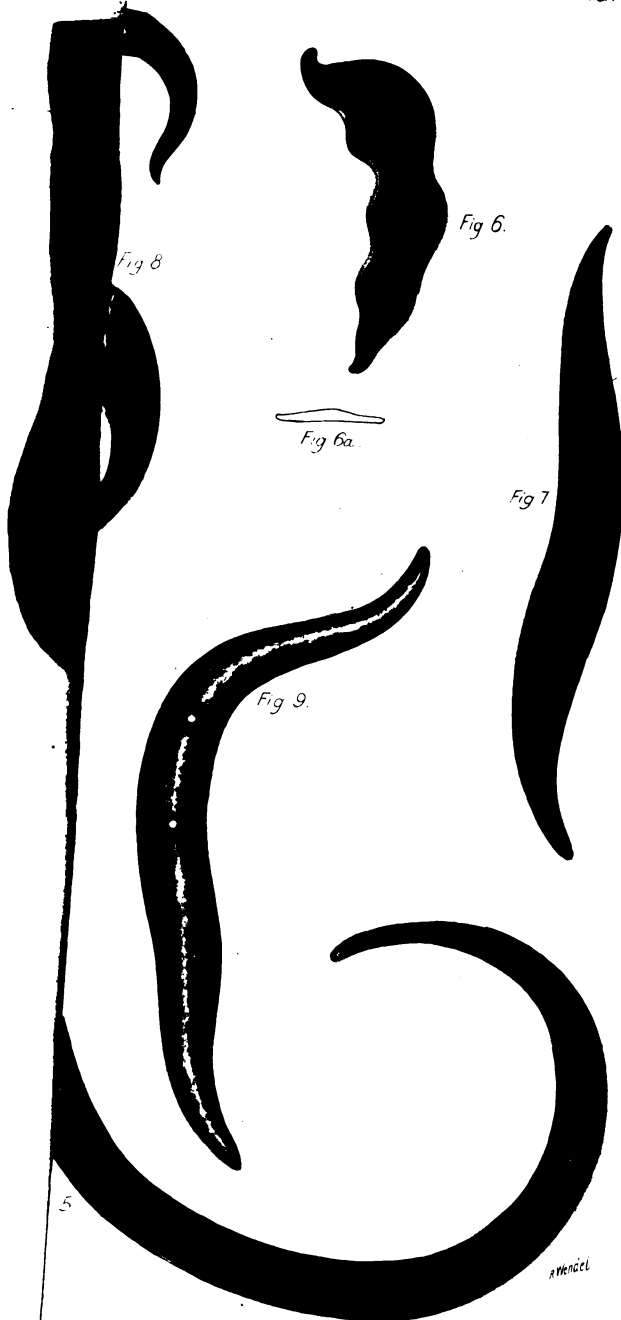
## DESCRIPTION OF PLATES.

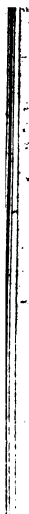
### PLATE XI.

- FIG. 1.—*Geoplana dendyi*. Large specimen  $\times 1\frac{1}{2}$ .  
 FIG. 1A.—*G. dendyi*. Transverse section of body.  
 FIG. 2.—*G. dendyi*. Enlarged view of anterior end.  
 FIG. 3.—*G. dendyi*. Enlarged view of surface of the body, to show the spotted nature of the skin.  
 FIG. 4.—*G. dendyi*. Enlarged view of the anterior end, dorsal view.  
 FIG. 5.—*G. dendyi*. Ventral surface  $\times 1\frac{1}{2}$ .  
 FIG. 6.—*Geoplana frosti*. Brown-coloured variety, at rest  $\times 1\frac{1}{2}$ .  
 FIG. 6A.—*G. frosti*. Transverse section across the body.  
 FIG. 7.—*G. frosti*. Greenish variety, moving  $\times 1\frac{1}{2}$ .  
 FIG. 8.—*G. frosti*. Dark variety, in which the dorsal light bands are feebly indicated. The specimen in this respect approaches *G. walhallæ*  $\times 2$ .  
 FIG. 9.—*G. frosti*. Ventral surface  $\times 1\frac{1}{2}$ .

### PLATE XII.

- FIG. 10.—*Geoplana munda*. Dorsal view  $\times 3$ .  
 FIG. 10A.—*G. munda*. Transverse section across the body.  
 FIG. 11.—*Geoplana walhallæ*. Dorsal surface of animal at rest  $\times 1\frac{1}{2}$ .  
 FIG. 11A.—*G. walhallæ*. Transverse section across body.  
 FIG. 12.—*G. walhallæ*. Animal in motion  $\times 1\frac{1}{2}$ .  
 FIG. 13.—*G. walhallæ*. Ventral surface  $\times 1\frac{1}{2}$ .  
 FIG. 14.—*Geoplana sulphureus*. Dorsal surface, life size.







W. B. Spencer del.

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FIG. 15.—*Geoplana mediolineata*, var. Specimen in which the lateral dark stripes are strongly developed, and forming thus an intermediate variety between *G. mediolineata* and *G. quinquelineata*  $\times 1\frac{1}{2}$ .

FIG. 15A.—*G. mediolineata*. Transverse section across the body.

FIG. 16.—*Geoplana alba*. Dark orange-coloured variety, at rest  $\times 1\frac{1}{2}$ .

FIG. 16A.—*G. alba*. Transverse section across the body.

FIG. 17.—*G. alba*. Greyish variety of the animal in motion  $\times 1\frac{1}{2}$ .

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ART. XV.—*Notes on the Marine Rocks underlying  
Warrnambool.*

(With Two Diagrams.)

By G. S. GRIFFITHS, F.G.S.

[Read August 14, 1890.]

The Borough Council of Warrnambool has recently bored for fresh water in the locality known as Albert Park, one and a half miles from the beach, 160 feet above sea level, and on the north east side of the town. The work was carried out under the supervision of Mr. Richard Bennett, the originator of the scheme, as I am given to understand.

The core brought up discloses an interesting series of sedimentary beds, which appear to have been laid down on a sea bottom, when this locality formed portion of an arm of the sea which extended from West to East, between the Otway Ranges and the Main Dividing Range. In early Tertiary times, Australia was elevated considerably, and the Secondary beds were greatly eroded in the area indicated. With the close of the Eocene, there was a great depression of the surface, and the Jurassic beds of the Otway were cut off from the same rocks of the flanks of the Main Dividing Range by a broad strait. Into this strait, the watercourses opening on its coast-lines brought down sand and mud, clay and chalky ooze, and these were outspread in wide thin beds. To these deposits, coral seems to have been added, for the waters, according to Professor Duncan, were warmer than those of the present seas, judging by the organic remains. These beds were subsequently raised above the sea level, and the Warrnambool bore penetrates the latest deposited, or uppermost of them, to a depth of about 400 feet. What may be the total thickness of these sediments hereabouts, cannot be stated, as there is no indication of proximity to any bottom in the bed of gault in which the boring rod broke; but in another part of this old strait, viz, at Winchelsea, a bore has

penetrated similar sediments for 2100 feet, without touching the Paleozoic bedrock.

A reference to the accompanying table of strata traversed by the Warrnambool bore, and prepared for this paper by Mr. Richard Bennett, will shew that the uppermost stratum consists of 81 feet 9 inches of limestone traversed by flint bands. This rock is of clastic origin, being composed of comminuted shell mixed with silicious sand, and bound together by a calcareous paste, and containing an abundance of flints. It is an ordinary littoral deposit. Mr. Bennett regards it as identical with the æolian limestone so abundant on the coast in the same neighbourhood, which it does resemble, both of them being accumulations of broken shell. I think, nevertheless, that the flint bands of the bore limestone differentiates the two deposits sufficiently. We know that when silicious sand is associated with calcareous sand, and the rock is below the line of saturation, the silica is rendered more or less soluble, and colloid silica segregates out of the mass just as do septaria in clays, and it thus forms flint nodules. This operation cannot proceed in a dry rock, as far as I know, and therefore flint bands in a limestone are evidence of that limestone having been immersed in water.

The æolian coast limestones of Warrnambool do not contain flints, except as remanies, as far as I can ascertain from some slight personal examination, and also from enquiry; and as they are quite recent as to age, and have never been submerged, it is unlikely that they would. The bore limestone on the other hand, was accumulated under the sea, and the flint bands attest this circumstance.

The three next beds in descending order are all clays, either red or yellow. They were deposited when this locality was more distant from the coast line, than it was when the just described and more recent calcareous sand-rock above it was accumulated. The order of superposition is evidence in favor of an elevatory movement, gradually bringing the area into shallower water, so that the deep water clays become buried under shallow water sands.

**BED NO. 6. CALCITE, 9 FT. 5 IN. THICK.**

This is an uncommon formation. Nearly all limestone is composed of the comminuted remains of shells and corals bound together by calcareous paste; but this massive stratum contains no clastic materials whatever, judging from

the stone composing this part of the core, which has the appearance of having been crystallised out of a saturated solution of mineral salts. Beds of gypsum and rock-salt formed in this way are common, but massive calcite so formed is rare, as far as I can ascertain. This is probably owing to the great solubility of bicarbonate of lime. Calcite is formed in two ways :—(1) In lakes which are drying up, the carbonate of lime being supplied to it by the streams which feed it. Evaporation of its waters tends to concentrate the salts, which are then deposited in crystals on its floor. (2) In nearly closed arms of the sea, such as the Adriatic, which is fed by numerous streams, which cut their courses through calcareous or volcanic rocks. The fresh water being the lighter, spreads out as a thin sheet over the salt water, and is in this way exposed to the evaporating influences of sun and wind, whereby it becomes a concentrated solution, and so deposits its salts as crystals.

The floor of the Adriatic is now being formed of calcite, and this is the explanation given of it by the text books; but I confess that I feel a difficulty in accepting the statement, that there can be sufficient concentration of the waters in the open sea to deposit carbonate of lime.

There is another explanation offered, which is that in the presence of sodium carbonate, lime salts are decomposed, and then calcite is precipitated.

The stratum of calcite in the bore at Warrnambool may have been accumulated in one of these ways. It may represent the bottom of such a lake as those which edge the Ninety Mile Beach in Gippsland, or it might have been deposited in the sea; but it seems to me that in the latter case, that sea must have been a partly closed one like the Adriatic, rather than an open strait like Bass' Strait, in which any sufficient degree of concentration of its waters would hardly be possible. Or again like the Rhone, which has at its mouth a deposit of calcite, the Hopkins which has a course which cuts across volcanic rock and limestone beds, may have poured into this arm of the sea a large volume of water charged with bicarbonate of lime which, coming into contact with carbonate of sodium in the sea water, is reacted upon and precipitated.

BED NO. 8. LIGHT YELLOW MARL, 26 FT. 6 IN. THICK.

Marl is generally a lacustrine deposit, and is then composed of the mouldered shells of mollusca, and the remains of *algæ*.

Marine marls generally represent old oyster banks. Either origin is possible for this stratum, as there are no organic remains to be identified in the sample from the bore.

BEDS NO. 12 AND 16. BEDS OF GREEN SAND, FULL OF FOSSILS.

These deposits are of a deeper water type than those just considered, the particles being coated with glauconite. This deposit is generally supposed to indicate a depth of from 100 to 700 fathoms; on the other hand, a species of green-sand is found opposite to the mouths of streams which traverse volcanic country, such as the Hopkins does. In this latter case, the green colour is due to a part of the pyroxene having been changed into chlorite. Such a deposit has been described by Professor Hutton as occurring at Waihao, in New Zealand.

I sent the fossiliferous sand to Dr. MacGillivray, of Sandhurst, for identification, and his report on it is, that there are no undoubted polyzoa in it, although one or two small masses in the parcel sent might be such, but none of the remains were sufficiently distinct to enable him to identify them. There were amongst the broken fossils some small calcareous tubes, which he did not understand the nature of.\*

BED NO. 13. BLUE GRAVEL, 22 FT. THICK.

No specimen of this was preserved, but from the description given, I think it may have been derived from slate rock. As no such rock outcrops, as far as I can learn, less than thirty miles away, this deposit must represent a river-borne material, and it must have reached its place of deposit at a time when the coast line was near by, as it would require a current of some swiftness to move it.

BEDS 11 AND 14. BLUE CLAYS.

This material was probably derived from the same slate rocks that yielded the blue gravel, being the finer washings produced by the grinding up of the pebbles.

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\* Dr. Dendy, who has seen these fossils, thinks that he can identify them with those of an early Tertiary deposit found in the Isle of Wight.

## BEDS 15 AND 17. GAULT, 30 FT. THICK.

These deposits of very fine bluish calcareous clay, must probably have been laid down in comparatively deep water, as the material is so fine that it would settle very slowly; it seems to represent the rainwash of a large area covered with chalk.

Chalk beds, of Eocene age, cover large portions of the South Western corner of Victoria, and in the past they must have been much more extensively outspread. The water-courses have removed large quantities of this rock, and mingled with clay derived from the abundant lava beds, the sediment has been discharged into the sea.

Taking into consideration the nature of the various beds shown in the bore, I think that they indicate a coast line which has been repeatedly shifted throughout the Tertiary. It would be a good thing to have this bore carried down, at least until the Secondary rocks were met with, for it is a fair presumption that the Tertiaries lie immediately upon an eroded extension of the Jurassic rocks of the Otway District.

## THE WARRNAMBOOL STRATA AS RESERVOIRS OF ARTESIAN WATERS.

The economic value of the boring operations deserves some consideration. The Warrnambool strata extend to the North in flat sheets, which rise in that direction at a rate of 35 feet in the mile, and which thin out against the Paleozoic hills at gradually increasing altitudes.

At Hexham, 30 miles distant, almost due North, the Hopkins, descending from the hills, at an altitude of 432 feet cuts its bed through Silurian rock first, then it enters the Tertiary limestones and sandstones which enwrap the older rocks, and which are the inland extensions of the rocks in the bore; and lastly it cuts into the lava which covers up the limestones.

On the North East, at Camperdown, these Tertiary beds rise to about 540 feet above sea level. They reach 731 feet at Penshurst, and 640 feet near Hamilton.

Thus the beds of the upraised Tertiary sea have a regular dip to the South. Fifty miles inland they are found at an altitude of 700 feet, whilst at Warrnambool where they have been pierced, they are 240 feet below sea level, or on a fall of over 1000 feet in that distance. The beds themselves



- |     |                                                                                          |     |     |     |
|-----|------------------------------------------------------------------------------------------|-----|-----|-----|
| 9.  | Coarse Sandstone with bands of flint, full of minute shells                              | ... | ... | ... |
| 10. | White sand and white clay                                                                | ... | ... | ... |
| 11. | Blue clay                                                                                | ... | ... | ... |
| 12. | Green sand, full of shells and coral-lines                                               | ... |     |     |
| 13. | Blue gravel                                                                              | ... | ... | ... |
| 14. | Blue clay (soft)                                                                         | ... | ... | ... |
| 15. | Gault or chalky blue clay, dry and hard                                                  | ... |     |     |
| 16. | Green-sand (No. 2 bed), shells and coral-lines, out of which water rose up tubes 225 ft. |     |     |     |
| 17. | Gault                                                                                    | ... | ... | ... |

|                   |     |     |   |
|-------------------|-----|-----|---|
| Total depth bored | ... | ... | 3 |
|-------------------|-----|-----|---|

MEMO.—A quantity of water rose out of green (No. 12), but this was lost in the blue clay and gault No. 16, a large body of water was found, which rose up tubes 225 feet, but on penetrating the lower bed of gault stopped here, the machine broke down, and I was unable to get through this bed.—R. B.

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# MEETINGS OF THE ROYAL SOCIETY.

1890.

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[N.B.—The remarks and speeches in the discussions are taken down verbatim by a shorthand writer, and afterwards written out at length with a typewriter, for reference and reproduction, if required; and therefore, more is seldom given herein than an indication of their general drift. If any person should wish to refer to the verbatim report, he can apply to the Secretary to the Society, who will give him an opportunity of perusing and copying it, or if he resides at a distance, so much as he requires will, upon payment of the cost of reproducing it, be forwarded to his address.]

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## ANNUAL MEETING.

*Tuesday, March 13th.*

The President (Professor KERNOT) in the chair.

The PRÉSIDENT announced that the retiring Office-bearers—Professor W. C. Kernot, M.A., C.E., President; J. Cosmo Newbery, C.M.G., B. Sc., Vice-President; E. J. White, F.R.A.S., Vice-President; James Jamieson, M.D., Treasurer; J. E. Neild, M.D., Librarian; H. K. Rusden, Hon. Secretary; and Professor W. Baldwin Spencer, M.A., Hon. Secretary, had been nominated by Mr. White and Dr. Neild for re-election. He understood that Dr. Jamieson was proceeding to England, and was not able to act as Treasurer, but Mr. Blackett had kindly consented to act in his absence.

The retiring Members of the Council had also been nominated by Mr. White and Dr. Neild for re-election. A vacancy had been caused by the lamented death of Mr. Steel, who would have been one of the non-retiring Members of Council on that occasion. T. R. Lyle, M.A., Professor of

Physics at the Melbourne University, had been nominated by Mr. Ellery and himself to fill the vacancy. A letter had been received from Dr. Rudall, who requested that his name should be struck out of the list for re-election, as he found that his professional engagements prevented him from attending the meetings with any approach to regularity. He knew that Dr. Rudall had been very much engaged during the past year, and sometimes had been absent from the Council Meetings, but he had shown his interest by invariably sending an apology, and indeed had been most conscientious in that respect. Still, under the circumstances, they would be compelled to withdraw his name.

Mr. JENNINGS moved, "That the meeting expresses regret that Dr. Rudall should find it necessary to withdraw his name from the list of candidates for re-election, and strongly appreciates the services he has rendered to the Society in the past."

Dr. NEILD seconded the motion, which was put by the PRESIDENT, and carried.

#### ELECTION OF OFFICE-BEARERS.

In the absence of a demand for a ballot, the retiring Officers of the Society were declared re-elected.

Professor KERNOT returned thanks on behalf of himself and his brother Officers, for the confidence reposed in them. The members might be sure, he said, that during the coming year their Officers would do all they could to forward the interests of the Society.

#### ELECTION OF MEMBERS OF COUNCIL.

The PRESIDENT stated that by their Rules they were precluded from receiving a nomination that evening, and therefore would have to elect a Council short by one member, and fill up the vacancy caused by the withdrawal of Dr. Rudall, later on, in accordance with special Rules provided for that purpose. The candidates for election were:—R. L. J. Ellery, G. S. Griffiths, Professor Orme Masson, H. Moors, C. A. Topp, and Professor Lyle. As no one desired a ballot, it became his duty to declare these gentlemen duly elected Members of the Council of the Royal Society.

#### REPORT AND BALANCE SHEET.

The Report and Balance Sheet were read and adopted on the motion of Mr. LLOYD MARKS, seconded by Mr. NEWTON JENNINGS.

The PRESIDENT in putting the motion, said he thought they had reason to be thankful for the record of work during the past year. It would be noticed that the Papers concerned with Biological subjects of interest in Australia, were very numerous, and the Society was doing good work in that direction. This was due to a great extent to the efforts of such gentlemen as Professor Spencer, Mr. McAlpine, and Mr. Dendy.

As this concluded the business, the meeting then resolved itself into an Ordinary Meeting.

#### ANNUAL REPORT.

The Council of the Royal Society of Victoria herewith presents to the Members of the Society the usual Annual Report for the year 1889. The following were the papers read during the Session :—

On the 14th March, Ordinary Meeting, held after the Annual General Meeting, R. L. J. Ellery, F.R.S., read a brief address on "Recent Progress in Astronomy;" G. S. Griffiths another on "Late Advances in Geology;" Dr. Jamieson a third on "Hygiene," and Professor Masson one on "Chemistry."

On the 21st March, the President gave an account of the most notable recent Engineering Works; Dr. Neild read a paper on Literature and Art, suggesting the formation of Section G; A. H. S. Lucas, reported progress for the Port Phillip Biological Survey Committee.

On the 11th April, A. H. S. Lucas presented the following papers from the Port Phillip Biological Survey Committee:— (1) "On a New Species of *Bicellaria*," by J. Bracebridge Wilson, M.A.; (2) "On Some New Species of Marine Mollusca, by the same; (3) "The Crinoids obtained in the Port Phillip Biological Survey," by Dr. Carpenter; (4) "Systematic Census of Indigenous Fish hitherto described from Victorian Waters," by A. H. S. Lucas, M.A., F.L.S.; (5) "Additions to the Fish Fauna of Victoria," by A. H. S. Lucas, M.A.; (6) "On the Occurrence of *Krausia*

*lamarckiana* at Williamstown," by A. H. S. Lucas, M.A.; (7) George Sweet read a paper "On the Old Red Sandstone Rocks and Fossils in the Mansfield District."

On the 9th May, E. J. White read some "Notes upon New Tables for the Barometric Measurement of Heights;" and the President, Professor Kernot, a "Note upon the Explosion of a Boiler in North Melbourne."

On the 13th June, J. Bracebridge Wilson, M.A., read a note on a "Trawling Expedition in the *Lady Loch* Steamer to Cape Schanck;" Professor Spencer read a note on "The Pineal Eye of *Mordacia*;" and R. L. J. Ellery, F.R.S., presented a paper by G. W. Perry on "Photo-Lithography."

On the 11th July, A. Dendy, M.Sc., read a paper on "The Australian Species of *Peripatus*;" Professor Spencer read another on "The Anatomy of *Amphiptyches urna*;" and J. J. Fenton read a third on "A French Calculimètre."

On the 8th August, A. Dendy, M.Sc., read a paper on "The Anatomy and Histology of an Australian Land Planarian;" and another paper, presented by J. H. Maiden, F.L.S. (Sydney), on "Liquid Kino," was read by one of the Hon. Secretaries.

On the 12th September, Baron von Mueller presented "Records of Observations on Sir William McGregor's Highland Plants of New Guinea."

On the 10th October, E. J. F. Love, M.A., read a paper on "A Proposed Gravity Survey of Australia;" and E. J. White read another on "Results of Longitudes from Lunar Observations."

On the 14th November, P. H. McGillivray, M.R.C.S., presented part XIII of his "Notes on New and Little-known Polyzoa;" A. Dendy, M.Sc., read a paper on "The Pseudo-Gastrula in the Development of Calcareous Sponges;" and D. McAlpine read one on "The Transverse Section of the Petioles of Eucalypts as Aids in the Determination of Species."

On the 12th December, A. W. Howitt read a paper on "The Organisation of Australian Tribes;" Sidney Gibbons read one on "The Illumination of Public Clocks;" and A. H. S. Lucas' paper on "The Occurrence of a Partially Double-chick Embryo," and Professor Spencer's, on "The Formation of Twins in the Hen's Egg," were taken as read.

Your Committee has to congratulate the Society upon a successful and prosperous year, and to remark that much of that success is due to the exertions and activity of Professor W. Baldwin Spencer. To him are mainly attributable the increase of the Government grant to the Society to £500, which was indispensable to the continuance of the publication of the New Series of the Transactions of this Society; and the pronounced success of the meeting in January of the Australasian Association for the Advancement of Science. The forthcoming Volume of the Transactions of that body will tell its own tale, and it will suffice to state here that 140 papers were read, and that all the details of the arrangements worked most satisfactorily.

Another subject of congratulation is the establishment of Section G, under Law LIII, on the 23rd August. The meetings of the Section were well attended, and have been the means of drawing over thirty new Members and Associates to the ranks of the Society. A remarkable feature in connection with this matter is, that of this unusual accession of Members, eight were ladies.

Your Council was unfortunately deprived of the services on the Council of Mr. E. Bage, almost immediately after his election last year, as he had to proceed to Europe on business in May. Mr. A. W. Howitt was, in July, elected as a Councillor in his place.

The following Members and Associates were elected during the year:—Members—W. H. Archer, R. Barton, Rev. Dr. Bevan, Dr. Bride, J. Cameron (country), F. H. Cole, Harry Edwards (country), W. R. Guilfoyle, F.L.S., E. Jager, Professor H. Laurie, LL.D., Professor T. R. Lyle, M.A., Dr. Wm. Maloney, D. McAlpine, F.C.S., Professor E. Morris, M.A., Miss H. Neild. Associates—Rev. W. Allen, — Baker, Miss Carmichael, Thos. Curry, H. Daglish, E. Davies, Miss Duerdin, D. Falk, Rev. Lorimer Fison, A. Harper, W. W. Harris, J. R. Hubbard, F. N. Ingamells, Hamilton Mackinnon, A. G. Melville, Miss F. Moors, Miss O'Brien, Miss Osmond, Rev. John Reid, J. R. Remfrey, Mrs. Riddell, J. Steele Robertson, B.A., Dr. Ross, T. A. Sisley, F. Slade, Frank Tate, E. A. Vidler, Mrs. R. B. Way.

Your Council regret to have to record the loss by death of several old and valued Members:—The Rev. J. E. T. Woods, Rev. Dr. FitzPatrick, Mr. W. H. Steel (who was a Member of the Council), Dr. H. C. Wigg.

The Librarian reports the addition to the Library, during the year, of the following publications :—From England 196 parts, Scotland 22, Ireland 10, Germany 99, Austria 41, Switzerland 3, France 25, Italy 61, Spain and Portugal 16, Holland and Belgium 61, Denmark 6, Sweden 32, Norway 2, Russia 34, Roumania 1, India 9, Mauritius 3, China 3, Japan 5, Canada 6, United States 40, Mexico and Guatemala 28, Argentine Republic 3, Victorian 142, New South Wales 28, South Australia 5, Queensland 57, Tasmania 11, New Zealand 7. Total publications received, 956.

**Dr.**      *The Hon. Treasurer in Account with the Royal Society of Victoria to March 1, 1890.*      **Cr.**

|                                     |          |                   |                                          |    |                   |
|-------------------------------------|----------|-------------------|------------------------------------------|----|-------------------|
| To Balance from 26th February, 1889 | ..       | £192 14 10        | By Printing and Stationery ..            | .. | £152 9 8          |
| " Government Grant—                 |          |                   | " Port Phillip Biological Survey ..      | .. | 2 4 0             |
| Balance of Vote for 1888-89         | £150 0 0 |                   | " Rates ..                               | .. | 4 15 0            |
| First Instalment for 1889-90        | 50 0 0   |                   | " Gas and Fuel ..                        | .. | 8 5 11            |
| " Entrance Fees ..                  | ..       | 200 0 0           | " Salary of Assistant Secretary ..       | .. | 62 18 4           |
| " Subscriptions for 1889 ..         | ..       | 29 8 0            | " Shorthand Records ..                   | .. | 33 3 0            |
| " 1890 ..                           | 260 8 0  |                   | " Hall-keeper ..                         | .. | 9 6 0             |
| " Arrears ..                        | 8 8 0    |                   | " Collector's Commission ..              | .. | 38 3 7            |
| " Rent of Rooms ..                  | 37 16 0  |                   | " Insurance ..                           | .. | 3 10 0            |
| " Sale of Transactions ..           | ..       | 306 12 0          | " Secretary's Postages ..                | .. | 41 15 7           |
| " Interest ..                       | ..       | 17 0 0            | " Repairs and Furnishing ..              | .. | 46 11 11          |
|                                     | ..       | 0 17 0            | " Books and Periodicals ..               | .. | 46 0 7            |
|                                     | ..       | 20 0 0            | " Freight ..                             | .. | 2 10 0            |
|                                     | ..       |                   | " Refreshments ..                        | .. | 3 4 6             |
|                                     | ..       |                   | " Treasurer's Postages and Petty Cash .. | .. | 3 14 5            |
|                                     | ..       |                   | " Balance, 28th February, 1890           | .. | 307 19 4          |
|                                     |          | <u>£766 11 10</u> |                                          |    | <u>£766 11 10</u> |

Compared with the Vouchers and Bank Pass-book and Cash-book, and found correct,  
**JAMES JAMIESON,**      (Signed)      **H. MOORS,**      } **AUDITORS.**  
**HON. TREASURER.**      28th February, 1890.      **JAS. J. FENTON,**

**Dr. PUBLISHING AND RESEARCH FUND. Cr.**

|                             |    |    |                 |                                              |    |                 |
|-----------------------------|----|----|-----------------|----------------------------------------------|----|-----------------|
| To Fixed Deposit in Bank .. | .. | .. | £300 0 0        | By Fixed Deposit in Bank of Australasia ..   | .. | £300 0 0        |
| " Interest on same ..       | .. | .. | 12 0 0          | " Interest transferred to General Account .. | .. | 12 0 0          |
|                             |    |    | <u>£312 0 0</u> |                                              |    | <u>£312 0 0</u> |

**STATEMENT OF ASSETS AND LIABILITIES.**

| ASSETS.                              |          |                   | LIABILITIES.                     |    |                   |
|--------------------------------------|----------|-------------------|----------------------------------|----|-------------------|
| To Entrance Fees (12) ..             | ..       | £25 4 0           | By Two Debentures ..             | .. | £10 0 0           |
| " Unpaid Subscriptions for 1890 ..   | ..       | 394 16 0          | " " (Interest Unclaimed) ..      | .. | 8 8 0             |
| " " (arrears) ..                     | ..       | 100 0 0           | " Estimated Unpaid Accounts ..   | .. | 200 0 0           |
| " Rent of Rooms ..                   | ..       | 20 0 0            | " Balance 28th February, 1890 .. | .. | 6637 4 8          |
| " Hall, Library, and Furniture ..    | ..       | 5000 0 0          |                                  |    |                   |
| " Balance of Grant for 1889-90 ..    | ..       | 375 0 0           |                                  |    |                   |
| " Two-thirds of Grant for 1890-91 .. | ..       | 332 13 4          |                                  |    |                   |
| " Publishing Fund ..                 | £300 0 0 |                   |                                  |    |                   |
| " General Account Balance ..         | 307 19 4 | 607 19 4          |                                  |    |                   |
|                                      |          | <u>£6855 12 8</u> |                                  |    | <u>£6855 12 8</u> |

## APPENDIX.

### (1) REPORT OF SECTION G (LITERATURE AND THE FINE ARTS).

I beg leave to report the continuous increase of numbers and interest in the Section. There are now seventy members of the Section, of whom forty-four have become Associates or Members of the Royal Society, for the sake of being Members of the Section.

The meetings have been well attended, the average being over forty.

The suggestion made by Mr. Archer last year, that some of Turner's sketches, now entombed in the vaults of the National Gallery, London, should be obtained on loan, if not permanently, for the instruction of students of landscape in the Art Schools of Victoria, has been revived by the Committee, and the sanction of the Council has been obtained to the taking of measures to secure them. Series of them, adapted to the object proposed, are understood to be obtainable, and would prove of the highest value to our rising local artists. It is much to be desired that the negotiations in this direction may be crowned with success.

Since the last report, at the meeting on the 24th November last, Mr. Rusden read a paper on "Parables." The next meeting was on the 28th February, when Mr. Ernest Jäger read the first of a series of papers on "The Orchestra, its Material, and How to Listen to It." On the 28th March, Mr. Sisley read a paper on "Affectations of Poetry." On the 25th April, Mr. Sutherland opened a discussion upon "Tennyson." On the 23rd May, the Rev. E. H. Sugden read a paper on "Dr. Murray's New English Dictionary;" and Mr. Archer another on "Professors of the University and Colonial Civilization." On the 27th June, Mr. Jäger read the second of his papers on "The Orchestra." On the 25th July, Dr. Neild read a note on "A recent Humourist, Jerome K. Jerome;" Mr. Sutherland read "Some Remarks on Alfred Domett, a New Zealand Poet;" and Mr. Rusden "A Note on Fiction." At the following meeting, on the 22nd August, Miss Blair read to an audience numbering sixty, "A Few Good Words for the Storyteller." On the 26th September, Mr. Geo. Gordon McCrae read a paper

"On the Seychelles, and their curious product, the *Cocode-Mer*." On the 24th October, Miss Osmond read a paper entitled "A Peep into the Studios of Melbourne;" and the Rev. John Reid one on "The Literary Outlook."

The Committee, in exercise of the powers conferred upon its members on their appointment, have added three to their number, to replace others. The following gentlemen now constitute the Committee:—Mr. Way, President. Members—Mr. Archer, Dr. Neild, Mr. P. D. Phillips, Rev. Mr. Reid, Mr. Rusden, Mr. Sisley, and Mr. Sutherland.

## (2) REPORT OF THE PORT PHILLIP BIOLOGICAL SURVEY COMMITTEE, 1890.

Members of Committee—W. M. Bale, F.R.M.S.; Rev. A. W. Cresswell, M.A.; A. Dendy, D.Sc., F.L.S.; P. H. MacGillivray, M.A., M.R.C.S.; Professor W. Baldwin Spencer, M.A.; C. A. Topp, M.A., F.L.S.; J. Bracebridge Wilson, M.A., F.L.S.; A. H. S. Lucas, M.A., B.Sc., Hon. Secretary and Treasurer.

During the year a large collection of Echinoderms (other than Crinoids), was forwarded to Professor F. Jeffrey Bell, of the British Museum; and one of Nudibranch Molluscs to Professor Ralph Tate, of Adelaide. With the exception of defraying the cost of freight of these collections, your Committee have incurred no expenses during the year.

Mr. Wilson has been assiduous, as usual, in dredging this summer. He will shortly be forwarding specimens of especial interest to our centre in Melbourne.

The quantity of material now in the hands of specialists is very considerable, and your Committee are of opinion that it is rather desirable to have this material reported upon, in order that in future we may be able to collect with more definite purpose, than to continue to accumulate undigested material.

Your Committee had anticipated that several reports on collections previously forwarded would have been received this year, and have been disappointed that none have as yet come to hand. It is, however, understood that certain of these reports are in progress, and are likely to be of great value when completed.

Professor Tate has forwarded the following list, which contains the names of a portion of the Molluscan collection sent to him :—

*Natica lamarckiana* (ampla, var.)  
*Fissurella scutella*.  
*Tugalia parmophoroidea*.  
*Fusus pyrulatus* (young example).  
*Crepidula immersa*.  
*Cancellaria spengleriana*.  
*Marginella turbinata* (dwarfed examples).  
*Cypræa piperata* (immature example).  
*Natica perumbilicata* (young example).  
*Cypræa* sp. (young example).  
*Diala magna*, n. sp.  
*Acmæa septiformis*.  
*Acmæa scabrilirata*.  
*Hipponyx antiquatus*.

Professor Spencer has investigated the structure of a remarkable Hydroid form, representative of a new family, to which the name of Hydroceratinidæ has been given. Only one genus and species of this family is known, viz., *Clathroozoon wilsoni*. This form is described and figured in the "Transactions" of the Society for the current year. Professor Spencer has also investigated the structure of a new species of Plumularia (*P. procumbens*), which is of interest on account of the structure of the polysiphonic stem, which differs from any hitherto described. It is also figured in the "Transactions."

Dr. Dendy has read before the Society the first part of his "Monograph on the Victorian Sponges," dealing with the organisation and classification of the Calcareæ Homocœla, and describing the Victorian species. The Council of the Society has decided to reserve one entire volume of the "Transactions" for Dr. Dendy's Monograph, and the first part is now ready for the printer.

Dr. Dendy has also published in the *Quarterly Journal of Microscopical Science*, a full memoir on that very remarkable Victorian Calcisponge, *Grantia labyrinthica*, and the so-called family, Teichonidæ.

Amongst the specimens of sponges obtained this year by Mr. Wilson, the most remarkable is a very beautiful and entirely new genus and species of Sycon, illustrating a novel

type of Calcisponge structure, which Dr. Dendy proposes to describe under the name *Synute pulchella*.

In the last report which he sent to Mr. Wilson, Professor Agardh gives the following additions to our Algal flora :—

|                                      |                                            |
|--------------------------------------|--------------------------------------------|
| <i>Dasya wrangeloides.</i>           | <i>Polysiphonia spinosissima.</i>          |
| <i>Epymenia angustata.</i>           | <i>Callithamnion laricinum.</i>            |
| <i>Callithamnion (species nova).</i> | <i>Ectocarpus (species ?)</i>              |
| <i>Dilophus fastigiatus.</i>         | <i>Callithamnion latissimum.</i>           |
| <i>Taonia atomaria.</i>              | <i>Polysiphonia (species forsan nova).</i> |
| <i>Zonaria stuposa.</i>              | <i>Pollexfenia nana.</i>                   |
| <i>Udotea (species forsan nova).</i> | <i>Griffithsia corticata.</i>              |
| <i>Rytiphlæa elata.</i>              | <i>Ectocarpus (species nova).</i>          |
| <i>Dasya (species forsan nova).</i>  | <i>Wrangelia setigera.</i>                 |
| <i>Caulerpa papillosa.</i>           | <i>Callithamnion divergens.</i>            |
| <i>Caulerpa vesiculifera.</i>        | <i>Cladostephus spongiosus.</i>            |
| <i>Laurencia elata.</i>              | <i>Delesseria marginifera.</i>             |
| <i>Lenormandia chauvinii.</i>        | <i>Codium elongatum.</i>                   |
| <i>Polysiphonia pectinata.</i>       | <i>Martensia elegans.</i>                  |
| <i>Epymenia halymenoides.</i>        |                                            |

Amongst the more interesting forms of life met with during the year have been :—

The rare shark, *Parascyllium nuchale*, McCoy, obtained by Mr. Gabriel.

*Argonauta oryzata*, great numbers of which were met with, first at Portland, and reaching the inner shores of Port Phillip at Brighton, St. Kilda, &c., about Christmas time.

A. H. S. LUCAS,

*Hon. Secretary and Treasurer.*

March 2, 1891.

## ORDINARY MEETING.

The minutes of the last Ordinary Meeting were read and confirmed.

Mr. Geagher signed the Roll book of the Society, and was introduced to the Meeting.

Mr. Ludovico Hart, and Mr. P. E. Woolf were nominated as Associates.

ETHNOLOGICAL SECTION.

The PRESIDENT stated, with regard to Mr. Woolf, that he was a gentleman accredited from important bodies in Europe interested in Ethnology and had already submitted to the Society a proposal for the establishment of an Ethnological Section of the Society. The Council had approved of the suggestion, and he had now to commend to the members this new Section. The laws of the Society gave them the power to form such a Section, and it was hoped that it would be formed, and do good work. It would be called "Section E." The reason for its formation was that, at the present time, traces of the Aboriginal races were growing fainter and fainter. They were rapidly passing away—their customs were being forgotten, and their productions, in the way of instruments, would shortly be no longer obtainable, and already there was some doubt as to the authenticity and exact object and purpose of the articles exhibited in our various Museums. It was thought that an Ethnological Section would be able to save from oblivion many interesting facts and relics connected with Aboriginal races—races which were doomed to disappear, and which were rapidly disappearing. They, and they alone, could do this work, and if they omitted to do it, the information would be lost for ever. That was the object of the formation of an Ethnological Section. The gentlemen most interested in Ethnology were Mr. Howitt and Mr. Fison, and their co-operation had been secured. There were collections of Aboriginal weapons and instruments at the Public Library and elsewhere, and if the Section could do anything in the way of getting these classified, good work would be done. A doubt had been suggested in many quarters as to the authenticity of some, and it was desirable that those that were not original should be eliminated, so that they would have genuine collections properly arranged and described. This was the object of the Ethnological Section, and it was a Section which certainly had opportunities for doing very good work.

Mr. JENNINGS drew upon the blackboard the outline of some curious battle axes, which he had obtained from an Aboriginal tribe in India. He believed they were still in India, and he would write for them, and give them to the Society.

The PRESIDENT said that this would be a matter of interest to the Ethnological Section. It was proposed that the work of that Section should be the obtaining of authentic specimens of native weapons, not only from our own Aborigines, and those of the South Seas, but other parts of the world. It had been suggested that the Ethnological Section of the Society should first of all undertake the work of collecting unquestionably genuine Victorian or Australian Aboriginal weapons and implements. Then, after having secured for Melbourne a perfect set, properly classified and accurately described, the duplicates could be exchanged with Museums in other parts of the world for weapons of other native races. If this work were undertaken, it would certainly be a very good thing to have the weapons which Mr. Jennings so kindly proposed to obtain. He thought, however, that the place for them should be more public than the Royal Society's Hall. Their proper resting place would be the Public Library. There were a good number of weapons there already, but so far as he knew, they had not been classified or examined by experts. If that collection could be completed, and the genuineness of the articles guaranteed, and the circumstances under which they were employed be accurately determined, it would be a very good work. Side by side with this, they could have specimens of weapons from other parts of the world, and the collection would become of very great value indeed. A complete and authentic collection of that sort for Melbourne was one of the great objects of this Section, and if Mr. Jennings could succeed in obtaining the weapons he had mentioned from India, they would be most thankfully received.

Dr. NEILD said that thirty years ago there had been an attempt on the part of the Society to make a collection of various curiosities, and it had not been found convenient to keep them, as they required more attention than it was in the Society's power to give. He would therefore suggest that the collection should be kept in the Public Library, or in the University. Professor McCoy took a great interest in the subject, and would no doubt be able to care for them.

Mr. WHITE remarked that Professor Mill, of Japan, when over here, wished to make a collection of native weapons. He went into rather a noted place, and said he wanted some native weapons, and he was asked whether he wanted

genuine or German ones. He inquired if they kept both. "Yes!" was the reply, "but the German ones are much cheaper than the others." He hoped that the manufacture of these sham weapons would be stopped.

#### LIBRARIAN'S REPORT.

Dr. NEILD, the Librarian, said that the substance of his Report had been published in the circular. The Library was making fair progress, and he was having the serials bound, and missing parts added, so as to make it as complete as possible. A catalogue had been compiled, which during the year would be printed and circulated among the members. He thought it would be a very peculiar production, as, in his opinion, a more curious Library in the way of variety and eccentricity did not exist. He supposed that 90 per cent. of the books of the Library were presentations. During the past year the shelving of the Library had been added to, and he thought in the coming year they would require still more. On the whole, considering the difficulties they had had to encounter, and the peculiar circumstances under which the Library had been formed, he thought their collection was really a unique one, and he was proud of having had the honour of being Librarian for the past twenty-five years.

#### THE RESERVATION OF WILSON'S PROMONTORY.

The PRESIDENT stated that he had received a letter from a gentleman interested in the question of the reservation of Wilson's Promontory as a National Park. It would be remembered that the subject was before the Society some time ago, and there had been considerable discussion, and a resolution had been passed in favour of the reservation. He believed it was proposed at the present time to subdivide and sell portion of the Promontory. He did not know how far the proposal had gone, or whether the members thought the matter was one that should be further pursued.

Professor SPENCER said that eighteen months ago the Field Naturalists' Club had taken the lead in getting up a deputation to the Minister of Lands, requesting him to make a reservation of the Promontory, but until the other day there had apparently been no result. Within the last

month, a notice had appeared in the *Argus*, stating that the Minister approved of the recommendation of the Field Naturalists' Club. Then there had appeared another notice, stating that the Minister had decided to reserve part of the Promontory for the purpose of laying out a township. Mr. Gregory had brought the subject before the Field Naturalists' Club at its last meeting, and it had then been decided that the Secretary should endeavour to ascertain the meaning of these contradictory statements; and if it were found, as seemed likely to be the case, that it was intended to reserve part of the Promontory for the laying out of a township, a deputation would be formed to wait upon the Minister of Lands, and the Royal Society was to be asked to nominate the members of the old deputation to serve again. He would propose that these gentlemen should be empowered to act, as possibly before the next meeting they would be under the necessity of waiting upon the Minister of Lands.

Mr. WHITE moved, "That the old members be again appointed to serve on a deputation to protest against the establishment of a proposed township." If once a township were established, then good-bye to a permanent reservation.

Mr. JENNINGS seconded the motion, which was put, and carried.

The PRESIDENT remarked that the argument in favour of the reservation was—that Wilson's Promontory was practically an island, was naturally isolated, and was a piece of country of varying character, with a very great range of elevations from the sea level to more than two thousand feet above it. It was surrounded by the sea except at one point, where it was connected with the mainland by a strip or sandy barren country, across which native animals would be very unlikely to travel. It was practically an island, and were a township erected, its integrity would be destroyed, and its insular position would be at once lost.

The following paper was read, "The Oology of Western Australia," by A. J. Campbell.

Professor SPENCER moved, "That Mr. Campbell be asked to read his paper," Mr. Campbell not being a member of the Society."

Mr. WHITE seconded the motion, which was put, and carried.

At the conclusion of the paper, some specimens were exhibited, and photographs circulated.

The PRESIDENT said that such a paper could hardly give rise to much discussion, seeing that it was simply a record of facts. At the same time the record of such facts was an exceedingly valuable piece of work. It was one of the first duties of a Society, such as theirs, to encourage the accumulation of such papers, and to preserve the results of such investigations in its publications. He trusted that such work would be vigorously practised by their Biological Members. It was one of the most important branches of the work of the Society, and one that tended to bring the Society credit in other parts of the world.

Mr. JENNINGS said he thought it would be interesting to know whether the birds were only to be found on the island referred to, and in that case, whether there were any peculiarities in their habits, and in the character of the country to explain why they were only found in that part of the country.

Professor SPENCER said they were very grateful to Mr. Campbell for giving them the result of his work, as hitherto very little had been done in that direction. With regard to the nocturnal petrel, which he believed was the only one known, he would like to know if Mr. Campbell had discovered any reason for this bird taking on its nocturnal habits, and whether there was one in South Australia.

Mr. CAMPBELL, in reply to Professor Spencer, stated that he had not found any reason why the bird should be nocturnal. As Professor Spencer said it had not been recorded before, he had been very much astonished on finding this to be the case. Referring to the mutton bird, he said he thought there was no instance of any petrel breeding on the mainland. They did so on the rocks sometimes, within two hundred yards of it. Possibly they were crowded out, as the place was honey-combed all over. In reply to a question by Mr. White, he stated that he had not noticed any rats on Rocknest Island. He believed Abrolhos Island was swarming with them at one time, but they were common European rats introduced by some shipwreck. The rainfall on the Guano Island, was about

eighteen to twenty inches in the winter time. The Guano is worked in the dry season, between October and May.

Mr. MCALPINE wished to know whether the birds were timid or bold on the island. Also, in reference to the colours, he would like to know if the colour of the nests always corresponded with the colour of the tree in which it was found, and whether the bird always confined itself to certain trees.

Mr. CAMPBELL, with regard to the fearlessness of the birds, stated that whilst arranging the plates for the photographs, one bird perched on his camera, and another took the liberty of perching on his head; and in placing the camera, he had to use sticks to get them out of the way. With regard to the nests being built only in certain trees, he did not think that was the case. The hakea bush was very thick, and in all probability the bird that built in the hakea bush would build in any other thick bush.

Mr. RUSDEN gave notice that at the next meeting he would move the appointment of a Committee to inquire into the available evidence on the subject of Cremation.

*Thursday, May 8th.*

The President in the chair.

The minutes of the previous meeting were read and confirmed.

The Rev. E. H. Sugden, B.A., Master of Queen's College, signed the Roll, and was introduced to the Members.

Six gentlemen were nominated as Members, and five as Associates.

Mr. Ludovico Hart was balloted for, and announced to be duly elected as a Member.

The PRESIDENT informed the Members of the decease of Mr. Reed, who, he said, had taken a great interest in the Society, and acted as its Architect gratuitously from its inception. He had left many monuments behind him, besides the Royal Society's Hall, as records of his skill and taste. The Society was greatly indebted to him for his professional assistance, which had always been given freely and ungrudgingly.

Dr. NEILD reported the receipt since the last Meeting of 478 publications.

Dr. NEILD also announced the receipt of a notice served upon the Society through the Caretaker, by the Inspector of Streets, to the effect that the trees growing round the grounds were encroaching too much upon the footpath. He stated he had ascertained that in no instance were the branches of the trees less than ten feet above the ground, and were not likely therefore to be a source of inconvenience to passers by. The complaint that they obstructed the light was nonsensical. Even if they did, nobody would suffer but the Society. He thought this was an unwarranted interference with the beauty of their grounds, and he would therefore call a Meeting of the House Committee who would investigate and report upon the matter.

#### CREMATION.

Mr. H. K. RUSDEN, in accordance with notice given at the previous Meeting, moved the appointment of a Committee of experts to enquire into this subject. He said:—It may perhaps be too much to expect you to remember that I had the honour of reading a short paper before the Hygienic Section of the Australasian Association for the Advancement of Science, on the subject of "Cremation, a Sanitary Necessity." I had collected a few papers and books on the subject, and thought it a pity that the occasion should pass without a paper on it. Shortly before the Meeting of the Association I ascertained that none had been offered on Cremation, so I undertook to produce one. In examining my materials, I was even more struck by the important evidence of the imminent danger to the public health involved in the present system of burial, and of the shocking and general desecration of the sepulchres of our dead nearly everywhere, than by the rapid progress now being made by Cremation. My paper was, in fact, devoted to the condensing of that evidence, to the neglect of equally interesting information as to the various methods in use in different parts of the world for effecting Cremation. I had long been aware of the superiority of Cremation as a means of disposing of the dead; in fact, I read a paper to the Health Society 14 years ago, advocating that among other measures of funeral reform. I have for some time also intended to take advantage of the first favourable opportunity of bringing it prominently under public notice. I think that time has come, and that the adoption of Cremation in

Melbourne now would not only be a wise sanitary precaution, but also a most important economical measure likewise. My particular object in raising the point to-night is to move according to notice that a Committee of experts be appointed to examine the evidence which I am in a position to produce, and more which I expect from England, and to report whether Cremation is not a real sanitary necessity; the best known means of putting an effective stop to the shocking but otherwise unavoidable desecration of sepulchres wherever there is a rapidly increasing population; and whether it would not be also an immense economy besides. I take it that any system would be unsatisfactory and inadmissible which did not provide all practicable satisfaction to reverential feelings. Attached to the Crematory therefore should be a commodious chapel or temple, in which memorial services could be held at any time. The Committee might also report upon the evidence produced of the complete and unavoidable failure of burial to satisfy reverential feelings in present circumstances wherever population increases as fast as it does in England, America, and Australia, and not only on the points raised in my paper, but also on the best mode of carrying into effect the objects in view. The verdict of such a Committee could not but have an important and useful effect upon public opinion on the scientific and other aspects of the question. The present juncture, when the town and suburban cemeteries have proved clearly inadequate to the purpose for which they were reserved, and when the only other alternative suggested, is the providing of another twenty-six miles away, seems particularly appropriate for recommending the substitution of Cremation. The distance of the Frankston cemetery must involve an oppressively increased expenditure to most persons in the community. I beg leave to move that a Committee be appointed to consist of Professor Masson, Professor Kernot and the mover, to examine and report to this Society upon the evidence of the failure of burial, and the best system to substitute for it.

Dr. NEILD, in seconding the motion, said he thought Mr. Rusden's proposition would in no way interfere with the convictions of those who objected to Cremation. It was very desirable that they should have a report upon the whole subject.

The PRESIDENT, in putting the motion, said he thought this was a matter of importance. It was, however, com-

paratively harmless from this point of view, that it did not commit anyone to any particular view.

The motion was carried unanimously.

Mr. LUCAS then read a paper entitled "Fishes new to Victoria not hitherto described."

The PRESIDENT said it was satisfactory to see the Biological Exploration of Port Phillip progressing, new specimens being obtained and new species named.

Mr. MCALPINE, referring to the peculiar marks by which the sexes could be distinguished in the species described by Mr. Lucas, said that this was an exception to the general rule. It would have been of great service to him had he been able to distinguish between the sexes of the cod when he had been engaged in freezing it, but the fishermen had been unable to give him any information on the subject. He thought it very desirable that, in the case of the food fish, some means of distinguishing the sexes should be discovered.

Mr. LUCAS, in reply, said that he believed there were no distinguishing marks on the commonplace food fish, but in the case of a few other species with coloured fins, a distinction could sometimes be made.

Professor SPENCER read a paper entitled "The Nomenclature of Chicken Embryos." At its conclusion, some lithographed illustrations were passed round.

The PRESIDENT said he thought Professor Spencer's suggestions very reasonable.

Mr. MCALPINE said he thought the proposal an excellent one, and would be a very desirable innovation from a student's point of view. Under the old hours system, great difficulty was experienced in determining the stage at which the embryo had arrived.

Mr. DENDY then read a paper "On the Victorian Land Planarians."

The PRESIDENT remarked that Mr. Dendy had followed up this subject with great vigour and perseverance.

Mr. HOGG said that Mr. Dendy's paper was so exhaustive that little could be added. He had lived in a place where planarians were very numerous and had been able to see

what Mr. Dendy had also noticed—that at certain times they were very scarce, but after a little rain would become very plentiful. At first, he had been very doubtful as to whether their different markings should be taken as indicating different species. Having found five or six different kinds huddled together under one log, he had been disposed to think that the varied colours were indications of different stages in growth. But from later researches, undertaken in company with Mr. Dendy, he had found that the lines were very well marked and distinct, and therefore Mr. Dendy had very properly decided to class those of different markings as of different species. He was glad that Mr. Dendy had been able to record so much during the short time he had had at his disposal.

Professor SPENCER said they were very much indebted to Mr. Dendy for having settled the point as to whether the difference in colour-markings could be taken as indications of difference in species. Another point raised was, as to whether the colouring was protective. He thought the only planarians he had seen in the open air were the most brightly-coloured ones, which would seem to favour that theory.

Mr. DENDY said he had very rarely seen a dull-coloured planarian out in the day time. Those most brightly-coloured were seen most frequently.

A MEMBER said that sometimes the colour was changed by the food upon which they fed. His gardener had pointed out to him an animal preying upon some of his flowers, and he had remarked that it changed its colour according to the plant upon which it was feeding.

Mr. DENDY said that even though it varied in the colour, the pattern remained unchanged. The tints of the stripes sometimes varied to a considerable extent.

Mr. LUCAS asked if Mr. Dendy had noticed any difference in shape between those planarians that remained under stones and logs, and those that went abroad. It seemed to him that those he had never met with abroad were comparatively flat, which would seem natural enough.

Mr. DENDY said that Mr. Lucas was quite correct. Those that ventured abroad were rounder in form. The first land planarian ever described was described by Darwin.

*Thursday, June 12th.*

The President (Professor KERNOT) in the chair.

The minutes of the last Ordinary Meeting were read and confirmed.

The PRESIDENT announced that the following gentlemen were nominated as members and associates:—Members—Messrs. H. R. Hogg and Thos. Lambert. Associates—Messrs. R. T. Elliott, Thos. Craig, and H. Grayson.

The PRESIDENT, in the absence of the Hon. Librarian, Dr. Neild, reported that 185 publications had been received from various parts of the world, 129 of which were printed documents and 26 maps.

Mr. Way and Professor Lyle having been nominated by the Council for the two vacant seats on the Council, were declared duly elected.

The following ladies and gentlemen were balloted for and declared to be duly elected:—Members—Pietro Barracchi, Rev. J. Mathew, Dr. Ambrose Wilson, Dr. Alex. Leeper, Dr. J. W. Springthorpe. Country Member—T. S. Hall. Associates—W. H. A. Pye, T. H. Hart, M.A., B.Sc., Miss L. M. Blair, Miss L. F. Blair.

The PRESIDENT, in announcing the result of the ballot, remarked that this great accession to their number was gratifying, not only to the Treasurer, who received the subscriptions, but to the Members generally, as it was an indication of the growing popularity of their Society. A great number had joined their ranks because of the attractive meetings of the Literature and Fine Arts Section, which had proved a very great success, but still many of those just elected were interested in severer studies.

Professor ORME MASSON read a preliminary note on "The Physical Properties of Ethides considered in reference to the Periodic Law of the Elements."

A discussion ensued, in which the President, Professor Lyle, Messrs. Kirkland and Marks took part.

Mr. DENDY read a "Note from the Biological Laboratory of the University of Melbourne, on the Presence of Corpuscles in the Liquid discharged from the Apertures of the Nephridia and Oral Papillæ of *Peripatus*."

A discussion ensued, in which the President and Professor Spencer took part.

Mr. McALPINE then read a paper entitled, "Investigations connected with the Copper-head Snake (*Hoplocephalus superbis*, Günth.), and its Parasites"—

(a) Observations on the movements of the heart in and out of the body.

(b) Remarks on a fluke parasitic in the body.

(c) On a nematode found in the stomach.

At the conclusion of section *a* of Mr. McAlpine's paper,

Professor SPENCER said he thought the movement of the excised heart along the plate was due to muscular contraction, and explained on the blackboard how this might be possible.

A discussion then followed on the definition of the word death, as used by Mr. McAlpine, in which the President, Mr. Marks, Mr. Dendy, and Professor Spencer took part.

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*Thursday, July 10th.*

The President (Professor KERNOT) in the chair, and 32 Members and Associates present.

The minutes of the last General Meeting were read and confirmed.

Mr. P. D. Phillips and Mr. George Gordon McCrae were nominated as Associates.

Mr. H. R. Hogg was elected a Member, and Messrs. H. Grayson, Robert Craig, Thos. Lambert, and R. T. Elliott, M.A., were elected Associates.

Mr. Ludovico Hart signed the Roll, and was introduced to the Meeting.

In the absence of Dr. Neild (the Hon. Librarian), the PRESIDENT announced that, since the last Meeting, 80 publications had been received from various parts of the world.

Mr. A. W. HOWITT read a paper on "The Eucalypts of Gippsland."

The PRESIDENT said that they must all bear witness to the completeness of Mr. Howitt's work. The paper just read

represented the accumulation of the observations of many years, and he had listened to considerable portions of it with very great interest. He thought it might be interesting to know what eucalypts grew highest on the mountains. He recollected camping a good many years ago on Mount Hotham, at an altitude of about 5700 feet above the sea level. The camping party had tried to utilise the eucalypt found there for tent poles, but as they only grew to a height of 15 feet, this was found to be a matter of impossibility. On the northern slope of Mount Feathertop, at an altitude of about 5500 to 6000 feet above the sea, he found some eucalypts only about 5 feet in height, and presumed these were one of the forms referred to. With reference to the height of eucalypts, after a number of actual measurements, he was of opinion that the popular height should be reduced 30 per cent. He himself had only come across one tree which was 300 feet in height. Some time since there had been great talk of a tree having measured 460 feet. Actual measurement, however, proved that it was only 219 feet 10 inches, or considerably less than half the height with which it had been credited. He was very sceptical, indeed, as to anything over 300 feet. Having been told of a forest where specially large trees had existed, after a series of measurements, he had not found one over 260 feet, and not many over 200 feet. The re-forestation of parts of Gippsland was a very interesting fact, and one he confessed he had never heard or dreamt of before. The general impression was, that the country had been denuded of its forests, and that by reason of its denudation, the floods and droughts were being rendered more severe. It appeared, however, that there was an opposite action going on, and it would be very interesting to watch and note, if possible, the effect of this upon the rainfall. The red-gum trees about Melbourne, such as those in Royal Park, were in many cases dying very rapidly, and he would like to know whether this was the natural decay of nature, or whether it had been accelerated by other natural causes. One of the curious phenomena noticeable in the dense forests of Victoria was the belts of dead trees found in certain places. On some high mountains, there were areas which looked as though they had been cleared, but where this could not possibly have been caused by the hand of man. Near the head of the Yarra, some years ago, he had come across a tract of country which was characterised by this peculiarity. It was one mass of fallen timber. The original

forest seemed to have died and fallen, and a young forest was springing up through it. This commenced rather abruptly, and extended for miles, when it ceased abruptly also. He would be glad to know if Mr. Howitt could give any explanation of such a phenomenon occurring in an utterly uninhabited district, where probably human foot had not trodden more than once or twice in the history of the country. Mr. Howitt's paper was a most valuable and interesting one.

BARON VON MUELLER concurred in the commendatory terms in which the President had spoken of this paper, which represented the result of observations which must have extended over a long series of years. Indeed, Mr. Howitt's observations had been so thorough that nothing seemed to have escaped him, not even the smallest forms of vegetable life. The *Eucalyptus amygdalina*, referred to by Mr. Howitt, had been noticed by the scientist who accompanied La Perouse on his first expedition. He was very much beholden to Mr. Howitt for the honor he had conferred upon him, of naming the new species of eucalypt he had discovered, after him. This was a eucalypt of great commercial value, and that it should bear his name was an honor of which he felt proud. Forty years ago he had commenced to study the eucalypts in the Botanical Gardens, and had been very much struck with the resemblance of the odour of the oil to that produced by a certain tree, having great medicinal properties, in India. From that time the study of the eucalypts had become very interesting to him. Mr. Bosisto had done great good in drawing attention to the eucalyptus oil question, and rendering it a great industry here. Mr. Howitt's paper was one of the most sterling contributions to the records of the Society, and his discovery, which had been brought out at that meeting, of a new and valuable timber, was one of very great importance. His endeavour to bring geographical knowledge to bear on the distribution of the trees was a work in an entirely new direction, and he had, in reality, for the first time by his tables and diagrams, succeeded in showing in a geographical manner the distribution of the trees, which could only be done after a great many observations, extending over a long series of years. Indeed, the work of the next century would be to carefully map out the distribution of the original vegetation in the various parts of the globe. In reality, this work had only just been commenced in Europe, and Mr. Howitt

was the first gentleman in this colony who had laboured in that direction. With reference to the height of trees, Mr. Howitt himself was a reliable authority, and had given the height of one tree at 415 feet. Over-statements had been made, but it should be remembered that it was not always possible to verify these statements. The first great error in over reckoning was made by Mr. Clyne, who had given the height of a eucalypt at 480 feet. He did not think that that gentleman had intended to make a mis-statement, but that it was an error of memory, and the height really was 380 feet. There was no doubt that the largest eucalypts were no longer in existence. Observations that he had himself made clearly proved the existence of trees a good deal over 200 feet in height, and he did not think it an exaggeration to say that eucalypts sometimes grew to the height of nearly 400 feet. Authors could not be responsible for the reports given in their writings, when the authority from whence they were obtained was quoted. It should also be remembered that it was not always easy to get a good base line for observations, and that it was much more difficult to measure our straggling eucalypts than the straight upright Californian pines. Another question of interest was the dispute going on in Europe, as to the value of eucalyptus honey. The question had arisen—Whether eucalyptus honey, containing to some extent eucalyptus oil, could be used for medicinal purposes? The honey was somewhat different to the honey made by domestic bees, and it was supposed that it was deposited in the hollow trees by native bees, or swarms of domestic bees which had gone astray. This honey did not readily become opaque, and might possibly be utilised as he had indicated. Finally, he congratulated Mr. Howitt on the success which had attended his long scientific investigations, and as he seemed as hale and hearty as ever, he hoped he might live a long time into the next century to carry these observations out.

Mr. WHITE said he was very glad indeed that the question of the height of the eucalypts had been mentioned. A few months ago, during the last Exhibition, these big trees had been dismissed in a shower of ridicule, as ghosts. He quite agreed with the Baron, that these trees might have existed. One of the largest ever referred to was given on his authority, as having been measured by one of his assistants with a tape line, and found to be over 400 feet. He would like to have the Baron's statement as to that tree. It was said that

Australia had been deposed from the position she once held in this respect, but if that measurement could be trusted, he did not see why she should not be re-instated.

BARON VON MUELLER, in reply, said he had not had an opportunity himself of obtaining any of the very large measurements that stood on record, and he thought that Mr. Howitt was in the best position to answer Mr. White's question, because he had given them information about a tree, which was stated from very reliable sources to be 415 feet high. In many instances the trees, the heights of which had been recorded, were fallen to the ground, and the measurement thereof must have been correct. In the early years, very little notice had been taken of the heights of the trees. Trunks of immense length had been utilised in the crossings of rivers and brooks, without the trouble to ascertain their length being taken. As the population became larger, the largest trees had disappeared, and he did not think it therefore very extraordinary to assume that eucalypts attained 400 feet.

A MEMBER said, with reference to the dead forest mentioned by Mr. Howitt, that he and his brother had come across one when travelling many years ago through the Gippsland District, between Port Albert and Sale. It was many miles in extent, and they had been very much impressed by the strange sight, never having before in their travels seen anything like it. When they camped at night, their surroundings presented a most weird appearance, the great white limbs of the trees reflecting the flames of their camp fires at a great distance all round. They could scarcely sleep at night for the noise of falling timber. They had been very much exercised in mind as to the cause of this, and he was very pleased to find reference made to it in Mr. Howitt's paper. Various explanations had been given, but this seemed a better explanation than any he had hitherto heard.

Mr. HOWITT said that, as to the height of the trees, so far as his own measurements were concerned, the most reliable was that of a fallen eucalypt, which, as it lay on the ground, measured 350 feet. The height of 415 feet, mentioned by the Baron as having been given by him, was given to him by several persons whom he considered reliable authorities. The owner of a saw mill at the place where it grew, told him that that was its height.

Mr. WHITE.—Was the tree cut down and measured directly?

Mr. HOWITT said that he understood it had been cut down and measured, but he had no means of checking the measurements. The highest tree he had personally measured, was one 350 feet in height, as he had before stated. The increase of floods was supposed to be caused by the diminution of timber, but he was inclined to think that they were to be accounted for by the hardening of the country generally, and more especially by the increased drainage which resulted from the making of roads and tracks. The water ran off the country far more rapidly than it had previously done, and even assuming that there was no difference in the rainfall, he would expect the floods to come down with far greater rapidity than was formerly the case. The cutting power of the Snowy River for instance, was very great, and he doubted whether there were 10 acres of soil left in the valley up to the high water mark. In many cases the sides of the valley were completely stripped to the rock, and so far as he knew, there was not a tree standing within the flood marks in that valley. This was due to the suddenness and rapidity with which the floods came down from the table land, such as the Gundai flood which occurred in 1849 or 1850. Similarly, he had noticed in the Omeo District that several gullies had been cut out. This all helped to increase the drainage.

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*Thursday, August 14th.*

The President (Professor KERNOT) in the chair.

The minutes of the last meeting were read and confirmed.

Sidney Plowman, F.R.C.S., J. Talbot Brett, M.R.C.S., G. A. Syme, M.B., F.R.C.S., were nominated as Members; and Lenthal Oldfield, Edward E. Rosenblum, M.B., and H. Best, were nominated as Associates.

Messrs. P. D. Phillips and George Gordon McCrae were elected as Associates.

The PRESIDENT, in the absence of Dr. Neild, the Hon. Librarian, who was unable to be present, read the Librarian's Report, which showed that 130 new volumes had been added to the Library during the past month.

Professor MASSON read a paper on "The Relations of Molecular Volumes and Boiling Points."

A discussion ensued, in which Messrs. Jackson, Love, and Professor Masson took part.

#### ANTARCTIC EXPLORATION.

The PRESIDENT, referring to the progress made, said that this matter appeared to have entered into a new phase. He said there was a definite offer from Barons Nordenskiöld and Oscar Dickson. Those gentlemen were willing to send a Swedish ship to the Antarctic regions, provided that Australia contributed £5000. The expedition would not be a whaling and scientific one, which all experts condemned, seeing that the two objects would be in conflict. It was proposed to despatch a purely scientific expedition. The offer had been before the Antarctic Committee, at which the following resolution was unanimously passed:—"This Committee learns with pleasure the munificent offer of Barons Nordenskiöld and Oscar Dickson, to defray half the cost of an expedition to the South Polar regions, Australia contributing (£5000) five thousand pounds. It cordially desires to accept the proposal, resolving to appeal at once to the general public throughout the Australian colonies for subscriptions for the purpose."

Several gentlemen had offered to head a subscription list for the purpose of raising the £5000 to be contributed by Australia towards the enterprise. Subscription lists would be shortly issued, and it was hoped that the appeal would be cordially responded to. The time for the despatch of the expedition would be the summer of the year 1891. The Committee had arranged that Mr. Griffiths should lecture on Antarctic Exploration before the Bankers' Institute. The printed paper issued to Members, gave very full information on the matter.

Professor SPENCER moved the Resolution No. 1 on the paper in the hands of Members.

Mr. H. K. RUSDEN seconded the motion.

Mr. GRIFFITHS, in supporting the Resolution, said he had had a talk with the Secretary of the Royal Geographical Society, and learnt that Mr. Gunderson had been in communication with the Minister for Foreign Affairs in

Sweden, and through that Minister, with Barons Norden-skiöld and Oscar Dickson. It was through that channel that the offer had come. Owing to a delay, which was not altogether avoidable, the matter had stood over a little longer than it should have done. It was now desirable to communicate with those gentlemen, and to acquaint them with the fact that we in Australia were now starting in earnest to raise the sum of £5000. He suggested that Mr. Gunderson should be authorised to telegraph to the Minister in Sweden, informing him that it was expected that the sum would be shortly raised, and asking if the Barons were still willing to proceed. If a reply could be received in time to be read at the meeting, it would be of assistance. The Geographical Society was willing to bear half the cost of the telegram, and it was hoped that the Royal Society would bear the other half.

Professor SPENCER asked to be allowed to substitute the following resolution for the one already proposed:—  
“This Society learns with pleasure the munificent offer of Barons Nordenskiöld and Oscar Dickson, to defray half the cost of an expedition to the South Polar regions, Australia contributing £5000. It rejoices to see that the proposal has been accepted, and resolves to support the Antarctic Committee in its appeal to the general public throughout the Australasian colonies for subscriptions for the purpose.”

Mr. RUSDEN agreed to the Resolution as altered, and on being put to the meeting, it was carried unanimously.

Mr. RUSDEN said that Mr. Macdonald had shown him a telegram from the Royal Society of New South Wales, and one from Adelaide, promising support to the movement.

On the motion of Mr. RUSDEN, seconded by Mr. GRIFFITHS, it was resolved that a report from New Zealand, on “The Whales of the Southern Ocean,” should be taken as read, and be ordered to be printed.

The PRESIDENT announced that the New Zealand Government had made a grant of £500 to aid the Australasian Association, and that Government would also do the printing for this year without charge.

Mr. G. S. GRIFFITHS, F.G.S., read a paper on “The Marine Sedimentary Beds underlying Warrnambool.”

The PRESIDENT expressed the opinion, that the results Mr. Griffiths had placed on record, were valuable for engineering purposes. The country around Warrnambool appeared to be of a very interesting nature, and the remarkable feature of fresh water springs at some distance from the shore, was one of a peculiarly startling character.

The Rev. Mr. CRESSWELL said that it was possible that the lower beds might be true Eocene. It was a pity that the expression "gault" and "green sand" were used. It was generally supposed that those terms had a technical meaning relating to cretaceous beds.

Mr. DENNANT said he was very much interested in the paper, and he was glad to find in it some of his own views confirmed. He fully agreed with Mr. Griffiths, that the limestone referred to was not part of the æolian stone. In that stone, he never yet saw any flints; he believed it to be a deposit of limestone in the ordinary way. He thought the term "gault" was a misnomer. The term had probably crept in, owing to its having been used in the *Warrnambool Standard* by Mr. Bennett, who was not a geologist. Calcite was a very common formation in that part of the country. In cave country generally calcite could be found, and in that he believed was an explanation of its origin. It was a deposit from water containing carbonate of lime in solution. He understood Mr. Griffiths to say that the "green sand" might probably be formed by the action of pyroxene on the lava. It was pretty certain that the carbonate of lime, although called "green stone," was laid down long before the lava was ever poured out. Pliocene beds were laid down long before the lava could have any access to such beds, as it would have to traverse a great many feet of superincumbent sand. The borings mentioned in the paper had been in his possession some time ago. He tested nearly all of them and, with the exception of one or two at the top, found them to be carbonate of lime. Mr. Griffiths followed the usual opinion, that the tertiaries of Western Victoria lie on the mesozoic beds of Cape Otway. It was impossible to say whether they did or not. The bore had not been sunk deep enough, but they had never been seen in that part of the country to lie on mesozoic rocks. Further west, there was an outcrop of those rocks, and there they were not of very great thickness. He had seen their base, in the heart of the district where they rested, on the so-called metamor-

phic rocks of the country. Until it could be proved by boring that those sections did lie on the mesozoic rocks, he preferred to suspend his opinion. In the district of the Wannon, the mesozoic rocks did not depart from the horizontal. He thought the level of 640 feet of the tertiary beds of Hamilton was not correct, as the highest point tested by the aneroid which they reached, was 450 feet. The highest point of Hamilton (the meteorological station) was 640 feet. That level was basalt, and it rested upon the tertiary beds. He would like to know if Mr. Griffiths had ever seen the fresh water spring at Cape Bridgewater. He once asked a fisherman to take him out to see it, but after starting, the man confessed he did not know where it was. He believed that a gentleman (now deceased), who was formerly well known as an advocate of a canal in that part of the country, relied a great deal on this welling out of fresh water.

After some remarks from Messrs. Jackson and Marks,

Mr. GRIFFITHS, in reply, said as to the origin of the rocks referred to by Mr. Marks, that no æolian rocks had been pierced by the bore, there could be no doubt that a large quantity of the coast rock was of æolian origin. There could be seen at the present time, heaped up shell fragments, forming sand dunes, which are being gradually cemented together by rain water carrying a certain amount of acid. That being so, Mr. Tennison Woods was so far quite right. As to the discussion whether certain rocks were sedimentary or æolian beds, he did not think it necessary to say anything on the subject, seeing that the rocks referred to by Mr. Woods, were not found near Warrnambool. He had not seen the spring of fresh water near Cape Bridgewater, but had only heard of it. It did not create in his mind any very great degree of surprise, because similar springs were common elsewhere. There was a very large spring of fresh water off the coast of Cuba. He had seen similar, but smaller, springs a few yards from the coast. The occurrence of calcite in caves, might be expected when it had been exposed above sea level. It was also common to find beds of calcite perforated by caves. It might have been unwise to apply the terms "gault" or "green sand," excepting to cretaceous beds. These terms were used by him in the paper, simply to describe the kind of rock that was passed through by the bore. The rock bore strong resemblance to

the "gault" of Great Britain, but of course, its age was entirely different. The term "green sand" had been applied by Professor Hutton to tertiary rocks in New Zealand. He did not use the terms as indicating the age of the rocks, but simply their mineral character. Professor Prestwich's text-book on geology, treated the subject of the admission of sea water to the land, and he expressed without any doubt the opinion, that under such circumstances as those described in the paper, the sea water did not percolate inland at all, but was absolutely excluded from the strata by the presence of fresh water in the beds.

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*Thursday, September 11th.*

The President in the chair.

The minutes of the proceedings of the previous meeting were read and confirmed.

The following were nominated for election:—Members—C. N. Hake, C. G. W. Officer. Associates—N. T. M. Wilsmore, Elderson Smith, Mrs. Elderson Smith.

The following gentlemen were balloted for and declared to be duly elected:—J. Talbot Brett, M.D., G. A. Syme, M.B., Lenthal Oldfield, F.R.C.S., as members, and Heinrich Best and E. C. Rosenblum, M.B., as associates.

The HON. LIBRARIAN reported that, since the last meeting, 77 publications had been received from various parts of the world. A number of volumes had been bound, the Council with its customary liberality having voted £40 for that purpose. A catalogue had been prepared, which would afford great assistance to those wishing to consult the library, and after going through it, he would put it on the table.

Professor ORME MASSON read a postscript to the paper last read by him.

Mr. MARKS said that the papers read by Professor Masson could not be adequately appreciated until printed and published, as they required an amount of study before the value of the results obtained could be apparent.

A Note on the Shell-bearing Mollusca obtained in the Port Phillip Biological Survey, by Professor Ralph Tate, of

Adelaide, was read by Professor Spencer in the absence of Mr. Lucas, to whom, as Secretary of the Committee, it had been sent.

A number of specimens had been forwarded to Professor Tate by Mr. Lucas, and this note had been received from the Professor, naming a portion of them.

Mr. DENNANT remarked that a curious fact with regard to Victorian shells was, that many of them had first been known in their fossil form before the living shells had been obtained. The importance of the work of searching for shells which was carried on by the Survey Committee could not be over estimated. If the living specimens had not been obtained, the fossils might have been thought to be those of extinct species, and a deposit which might otherwise be defined as miocene would perhaps be proved by the living shell to be pliocene. The Society was to be congratulated on the work that was being done.

The PRESIDENT said that the members would be very glad to know how the Survey was progressing; what was being done, and how much more was to be done; and whether the results were up to expectations. The Survey was started some three or four years ago with some enthusiasm, and although little had been heard of it lately, he believed the work was being carried on steadily and well by those interested in it. Still, the rest of the members were in ignorance of what was being done.

Professor SPENCER said that the Committee had been established about two years, during which time a certain amount of work had been done. A little dredging had been done in the immediate neighbourhood, but the greater proportion of the work had been done by Mr. Bracebridge Wilson, who spent the whole of the summer in dredging. Most of the dredging had been done close to and outside the Heads. When dredging in the still deeper water had been attempted, probably, more interesting specimens would be obtained. At the same time, a very large collection had been made, which had been divided into different groups and sent to specialists, as Dr. Herbert Carpenter and Mr. Jeffrey Bell. The sponges were in the hands of Mr. Dendy, who was spending a great amount of time on them, and intended shortly to bring out a general work on the subject which would be of great value. He was doing anatomical work, which took much more time than the

naming of the species, and if any of the Members cared to go to the University and see the collection, the magnitude of the work would be better understood. Before the sponges were named, two or three years at least must pass by. The specimens of Polychæte worms, had been sent home to Mr. Cunningham, at the Marine Biological Station, Plymouth, who was one of the best workers in that subject. Another group—the Tunicata—had been sent home to Professor Herdman, of Liverpool, who was at work on them, together with a large group of the same forms sent from Sydney. Others had been sent to different workers, and preliminary reports had been obtained. Professor Hatchett Jackson was at present working at a Report on the Pycnogonidæ, which would be illustrated and published in the Society's "Transactions." All the fishes had been named by Mr. Lucas himself. He thought as much work had been done in two years as could have been expected. In a year or two's time a great deal more in the way of results might be shown, as then their reports would be coming in. Mr. Bracebridge Wilson was still dredging; he had collected most of the animals he was likely to get easily and did not often come across new specimens, and those sent in were getting fewer in number, although, probably, more valuable. It might be some time before full reports would be able to be presented.

The PRESIDENT said they were glad to hear that matters were progressing satisfactorily; at the same time, it appeared that the work was only being done in the vicinity of Sorrento, and when it was considered that Port Phillip was something like 200 miles in circumference, with coasts of a very varied character, it was to be hoped that the other parts would receive attention in due course, although it was difficult to see exactly how it was to be done. For instance, was anything interesting likely to be discovered along the coast from Williamstown to Geelong.

Professor SPENCER said that Mr. Wilson made Sorrento his headquarters during the summer, and consequently, very little dredging had been done in the immediate neighbourhood of Hobson's Bay. He thought that the part of the Bay that had been done was likely to repay the best.

Mr. DENDY said that more dredging was not what was wanted. Mr. Wilson swamped them with material. He had received something like 1500 glass jars filled with sponges, and he could not properly work out one species in

one week, whilst the preliminary work of sorting occupied many months. The making of each preparation involved a considerable amount of labour. What was wanted was more labourers, not more exploration. Mr. Gabriel had done a lot of work in exploring other parts of the coast. A little work had also been done on the north of the Bay. The Field Naturalist and University Science Clubs had made excursions and brought back many valuable specimens.

The PRESIDENT said it seemed as though the work were going on outside the original scope of the survey.

Mr. WAY thought it was always contemplated that the interior of Port Phillip should receive first attention, and that the Survey should afterwards be extended round the coast.

Mr. DENNANT said that when the shells in Victorian waters were originally named, a number was obtained merely as dead shells in the absence of living ones, and it afterwards transpired that many of them did not belong to Victorian waters at all, but had been brought from other parts of the world as ballast, and a good many had to be excised. He took it that the Biological Survey was obtaining living specimens, and as far as the mollusca were concerned, the value of the work must be very great. A long list of the shells obtained in Portland Bay had been published, but he had no doubt that a number of them were exotics, owing to the number of ships from different parts of the world laden with ballast anchoring in that locality. This might be the case in Port Phillip. He would like to see dredging operations in Portland Bay and on the Gippsland coast. It was very noticeable that shells found in South Australian waters were not taken up in Victorian waters, and it would be rather interesting to know at what point they commenced to appear or disappear. A friend of his, when dredging on one occasion, had been astonished by getting a tremendous haul of shells, but he had afterwards found that, at that very spot, the ballast of a vessel had been thrown out. This was a source of error which needed to be guarded against, and the only safe way was to get the living shells.

A paper on the "New Britain Currency, or Shell Money," communicated by the Rev. R. H. Rickard, was read by Professor SPENCER, who said that this was the first paper

of a series which was being written by Mr. Rickard on the habits of the New Britains, and therefore Members might look forward to receiving more information shortly.

The PRESIDENT said this paper was unquestionably one that they would be very glad to have in the "Transactions," and he trusted that they would receive many more like it. With the spread of commerce, the old customs of the natives were being broken up, and while they continued to adhere to them, it was desirable that they should be accurately recorded.

On the subject of "The Sending of Pendulums from Kew Observatory to Victoria, for the Proposed Gravity Survey,"

Mr. ELLERY said Members would probably remember that some time ago Mr. Love had brought the question of a gravity survey prominently before them, and the probability of having such a survey then evidently depended upon the possibility of getting suitable apparatus wherewith to make it. Some twelve months ago, Mr. Love had read a paper with regard to the desirability of extending the pendulum observations (which had been taken in one or two points in Australia) more over the continent, and the matter was then discussed at some little length. The question then was, whether pendulum apparatus already in existence could be borrowed, or whether it would be desirable to get new apparatus. He had undertaken to communicate with the authorities at Kew and the head of the Indian Department in London, to see if he could get the pendulums which had been used in the great survey of India, and which he believed were lying unused at Kew. He had received a letter, stating that the pendulums had been finally swung at Greenwich and Kew, and were in such a condition that they could easily be transferred to the Observatory at Melbourne if there were any prospect of their being made use of. These pendulums had been used throughout the survey in India, and swung over nearly the whole extent of that survey. One of them had been brought out to Australia at the time of the last transit of Venus. Mr. Smith and Mr. Pritchard, of the American Coast Survey Department, were despatched to take observations in Australia and New Zealand, and swung one of the pendulums in Sydney. If a plan could now be devised, by which a survey could be carried out, there would be no difficulty in getting the pendulums. It was considered

very desirable and important that the pendulums should be swung in some of the central parts of Australia. He would undertake to get them out immediately if assured that there was some prospect of their being used for the purposes indicated. The best way, he thought, would be to form a sub-committee of the Royal Society, and to empower them to take the necessary steps. At last year's meeting, it had been stated that it was thought there would not be very much expense involved in the matter, so long as the instruments were obtained. Mr. Love had said he would be quite willing to go with the pendulums into the interior, or to any other place thought desirable, in order to swing them. At all events, it would involve some expenditure, and he thought the best way would be to appoint a sub-committee to consider the matter, and report thereon as soon as possible, so that the pendulums might be obtained in time to be used before the coming summer was over. He therefore moved, "That a sub-committee, consisting of Professors Kernot, Masson, Lyle, Mr. White, Mr. Love, and the mover, be appointed to discuss the matter, and to report thereon to the Society as soon as possible, Mr. Love acting as Secretary to the Committee."

This resolution was seconded by Mr. WAY, and carried unanimously.

The PRESIDENT suggested, in view of the approaching Antarctic Expedition, that there would be a possibility of getting the pendulums swung in some high Southern Latitude. Gravity experiments had been made in the Northern Hemisphere, but very few in the Southern Hemisphere, and he thought that a gravity determination in a high Southern Latitude would be a remarkably interesting addition to any physical information the Expedition could gather. Although the pendulums were by no means new, he presumed that they were sufficiently up to the times. He understood that it was the intention to swing them in vacuo. That was theoretically the best way, if it could be done satisfactorily. He did not know if that were generally done in the cases of other determinations. Perhaps Mr. Ellery would give them a little further information, especially as to the possibility of having a determination of the gravity in a high Southern Latitude.

Mr. ELLERY said, with regard to the swinging of the pendulums in vacuo, that that had been done in several places.

in India, and the pendulums were now swung in vacuo at home. They were quite up to the modern form, being, in fact, the last pendulums that had been made. They were made on the most approved principles for the Indian Survey in 1876 or 1877. He did not think any pendulums had been made since, except one or two experimental ones in Germany. With regard to taking them down to the Southern regions, they could be easily carried if a place could be obtained to swing them in, and if an Expedition were carried out, it would be very desirable that one of the pendulums should go with it.

The PRESIDENT remarked that all the instruments needed for such gravity determinations would be a pendulum with all its subsidiary apparatus, a clock, and a transit instrument for regulating the clock.

Mr. ELLERY said it might be done with chronometers, but he did not think that the pendulum could be so well swung with the chronometer as with the clock. Of course it was a *sine quâ non* that to get good pendulum results, the observer must be well trained, and have had a lot of actual experience.

The PRESIDENT suggested that such experience could be obtained by one practising in Melbourne until thoroughly acquainted with the work. At how many places was it proposed to swing the pendulum?

Mr. ELLERY thought they should be swung in two or three places at least, and that in fact it would be hardly worth while getting them out unless they were swung in four places. There was no necessity to swing them in a great number of places.

The PRESIDENT: What about sea coast *versus* inland?

Mr. ELLERY said that, if experiments were made in that way, the observations might be multiplied. The most interesting experiment would be to repeat the observations formerly made in Melbourne and Sydney, and in the interior plains as distant from mountains as possible.

Mr. WHITE said the Overland Telegraph line would facilitate the matter. The exact time also could be conveyed along the line direct from the Observatory.

Professor MASSON wished to know where the money was to come from.

Mr. WHITE supposed the Society would be asked for it, but thought the different Governments ought to contribute something.

The PRESIDENT said the first thing would be to arrive at the approximate cost of the survey, and to determine how many observations should be taken. It was suggested that there should be a certain degree of co-operation with the other Colonies. Would it be useful to extend the survey to Western Australia and New Zealand?

Mr. ELLERY thought it would be useful if it could be done. The matter should be left in the hands of the Committee without any restrictions, so that they might submit a report and advise as to what should be done.

The PRESIDENT thought it desirable that the Committee should take an early opportunity of considering what should be done, how much it was likely to cost, and in what direction they could look for the money. If the cost were considerable and the stations numerous, he presumed they must look for some Government assistance.

Mr. ELLERY said that before he would feel free in asking for the pendulums to be sent out, it would have to be decided that observations were to be made, and in one case, at least, towards the centre of Australia. That would be a good excuse for getting them out.

The PRESIDENT thought that if they were used in Sydney, Melbourne, Adelaide, and the interior—Bourke had been suggested—that would be sufficient.

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*Thursday, October 9th.*

The President in the Chair.

The minutes of the preceding meeting were read and confirmed.

The PRESIDENT stated that a communication had been received from the Geographical Society of Berne with reference to an International Congress of Geographical Science to take place at that city in August 1891, and inviting the sympathy and presence of the Members.

In the absence of Dr. Neild, the PRESIDENT read the report, which was to the effect that 171 publications had been received from various parts of the world.

Mr. DENNANT, F.G.S., then read a paper entitled "Notes on Miocene Strata at Jemmy's Point, with brief remarks upon the Older Tertiary at Bairnsdale," which he illustrated by a map of the district. At its conclusion,

Mr. GRIFFITHS said that the district which Mr. Dennant had visited and described was very interesting from a geological point of view, and was one of a large number of important districts which had been, practically, wholly neglected, owing to the fact that the Government of Victoria had been ill-advised enough to dismiss its Geological Staff some years since, in that way preventing the completion of the Geological Survey of Victoria, which, if it had proceeded on the lines laid down by Mr. Selwyn, would have been very far advanced to-day. It was very important that proper plans and sections should be prepared, as without them it would be impossible to complete the Geological Map of Victoria. While the Staff of the Government Geological Department was so short-handed, it would be impossible for the work to be proceeded with; and, under such circumstances, it was very fortunate that they had in the community a gentleman like Mr. Dennant, who had given special attention to the strata and horizon he had just described, and who therefore brought to bear upon his work a considerable amount of special knowledge which was of the utmost importance in dealing with such a district. Mr. Dennant's investigations of the strata of the Muddy Creek, and the coast as far as Mount Gambier, the results of which had from time to time been given to the Society, showed that he was a most competent observer in this particular department of the science; and he (Mr. Griffiths) was very glad indeed that, short as Mr. Dennant's visit had been, he had been able to gather so much data, of such a valuable and interesting character. When they heard that the fossils which he had been able to obtain from these localities presented a facies which was singularly similar, as far as some of the beds were concerned, to the celebrated Paris basin, and also to the beds of the Alabama district of America, they had an important addition to their geological knowledge; and the thought was suggested, that this was evidence of a development in life which bore a relationship to the development which was proceeding in Europe and America during the eocene and pliocene periods. It struck him that very important and interesting results might be obtained if, in addition to

collecting the fossils that were to be found cropping out of the side of the cliff on the southern side of the river, investigations could be made at greater depths, by means of wells or bores. They might thus get evidence of a sequence from, perhaps, as far down even as the jurassic beds. At any rate, they had secondary strata running through Gippsland, which cropped out to the south of the Drouin district, and disappeared as one proceeded eastward, under tertiary beds; and in a number of places, as at Bairnsdale, Port Albert and Sale, calcareous strata had been marked, some of which were in all probability of miocene age, the principal ones being, of course, pliocene; and these mesozoic beds possibly dipped right under the Gippsland Lakes, where they were concealed from view. If a bore were to be put down, and if they were fortunate enough to pass through fossiliferous strata, they might obtain a complete sequence from the mesozoic up to the miocene beds which Mr. Dennant had reported upon. It would be very interesting indeed, if they could have such a collection of the underlying strata made; but, while that was not likely to be done at present, it struck him that, by following up the creeks, it might be possible to obtain sections which would be of successively older age, for it would be easily understood that, in following up such a creek, they would at length reach a part where the tertiary beds would be found thinning out, and the upper silurian beds coming into view. It might be that beds which lay far below the water line, at one point approached the surface as they thinned out against the silurian outcrops; and by thus following up the creek, and examining the sections which it might present, they would easily obtain strata which could only be reached by sinking to a great depth in another locality. In this way, they might get evidence of beds very much older than the miocene beds reported upon by Mr. Dennant, and it would be very interesting to get evidence of their character. That all the beds in that locality were not on the same geological horizon, they had evidence from the different fauna obtained from the strata at Jemmy's Point on the one hand, and at Bairnsdale on the other. Mr. Dennant had determined the Bairnsdale beds to be of eocene age, and the Jemmy's Point beds to be of miocene age, so that here they had two distinctly different horizons within a short distance of each other; and seeing that the district had been very slightly explored geologically, a very slight attention to the

neighbourhood would probably yield evidence of other horizons. He thought they were under a heavy obligation to Mr. Dennant for having given attention to this district, and he had certainly added, in a material way, to their knowledge of the geology of Victoria.

The PRESIDENT said that one question suggested by the debate, was the question whether something might not be done in the way of urging the Government to re-commence the geological survey of the Colony on some complete system. In the old days there was a definite geological department, with Mr. Selwyn at the head, and a number of beautifully-finished geological maps had been brought out, covering parts of the Colony. They had from time to time, at rather irregular intervals, received occasional maps of isolated districts, but there did not seem to be anything like a uniform and comprehensive survey of the country in progress. Could not something be done in the way of agitating for such a survey? It was considered part of the duty of the Governments of most civilized countries to conduct such investigations, and in this country, where mining formed such an important factor in our progress, and contributed so largely to our revenues, one would have thought that geological surveying would be regarded as of sufficient importance to warrant a reasonable yearly expenditure. The geological survey under Mr. Selwyn had been given up at a time when the country was very much poorer than at present, and its revenues very much smaller, and in those days probably there had been economical reasons for the step taken; but now, when there was double the population, and double or triple the revenue that existed at the time of Mr. Selwyn's departure for Canada, it surely would not be a very large thing to ask that something should be done in the way of steadily and continuously following up the geological survey of the country on lines similar to those laid down by Mr. Selwyn.

MR. GRIFFITHS thought the suggestion a very excellent one, and if it were within the functions of the Society to move in the matter, steps should be taken to memorialise the Government. Very excellent work was being carried on by Mr. Reginald Murray and his assistants, but under existing circumstances, that gentleman could not possibly do any large amount of work; and he was quite sure that if the staff were re-organised and set to work, the benefits derived

by the country would a great deal more than cover the cost. He would be very pleased to do what he could if any endeavour were made to induce the Government to give some consideration to the matter, and suggested that it might be as well to form a committee.

The PRESIDENT thought this might be done. At any rate, it was a matter worthy of consideration.

Mr. GRIFFITHS thought it would be well to bring the matter forward at the next meeting of the Council, and to move the appointment of a sub-committee.

Mr. ROSALES said he was very glad to have heard the matter mentioned. A Royal Commission on Gold was now sitting, and he thought it very probable that if the matter were mentioned to them, they would take it in hand.

Mr. DENNANT was very glad that attention had been drawn to the matter. It had been his dream for many years to see this work again undertaken. He spoke of the difficulties experienced by individual geologists in their investigations without the aid of geological surveys, and stated that many inaccuracies existed in the maps which they did have, owing to the rapidity of the surveys made. Occasionally one of the members of Mr. Selwyn's old staff might happen to go over the ground, and a few corrections would appear in the next geological map, which would be published probably ten years afterwards, but really that was not the way to deal with a Colony like this. He certainly thought the Government should at once proceed to form a competent surveying staff, so that the Colony might be surveyed with the greatest possible despatch. Outcrops of valuable minerals and things of special scientific interest might be met with in different parts of the Colony, and yet such work was left to amateurs, who were generally too busy with their own affairs to be able to give much time to the examination of the strata of the Colony. Most of the gold-fields, he believed, had been fairly well surveyed, but the major part of the country was left untouched. In many instances the geological work which had been done needed correction, and he really thought the Society would be doing good work if a sub-committee were formed to urge upon the Government the necessity of making a complete survey of the country. He had no doubt that in the mesozoic country there were numerous outcrops of coal which had not yet been met with; and if a complete survey were made of the

Gippsland country, as had been advised by Sir James Hector two years since, they would be able to determine with more accuracy whether those outcrops were likely to continue underground for any distance. A geological surveyor would be able to determine by the elevation whether two outcrops, say a mile distant from each other, belonged to a continuous bed, running perhaps beneath a neighbouring hill; whereas at present one person found one outcrop and another person another, and both reported their discoveries as totally different beds. An agitation by the Society would, he thought, have a great deal of weight with the Government, in inducing it to consider the propriety of re-establishing a survey of this country on a proper basis. Mr. Selwyn had done remarkably good work, and he supposed no better *résumé* had been written than that which appeared in the Exhibition Essays in 1886. Since then nothing had been done by the Government, and the whole thing had come to a sudden stop. If they were to go into the Public Library, and look at the work which had been done by Mr. Selwyn in Canada, they would be able to form some idea of what he might have done had he continued his labours in Victoria.

The PRESIDENT said that the matter should be discussed at the next meeting of the Council, and as there seemed to be a movement in the same direction elsewhere, it was to be hoped that ere long the surveying of the Colony would be proceeded with, if not on quite such liberal lines as those laid down by Mr. Selwyn, at any rate on lines very much extended in comparison with those that had existed during the last eight or ten years.

Mr. GEORGE G. MCCRAE then read a paper on the *Coco-de-Mer*, specimens of which were exhibited in the room. A copy of the *Botanical Magazine*, lent by Baron von Mueller, containing an account of the tree, was also handed round among the members. At the conclusion of the paper,

Mr. MCCRAE, in reply to the President, said that he had endeavoured to introduce the plant into Queensland by sending a nut to the curator of the garden at Bowen, but as he had heard nothing as to the result of the experiment, he had concluded that the seed had perished *en route*. He had tried another in a hot-house in Victoria, but this had proved to be a failure. However, he had been promised two more with the seeds well-protected, and expected to

receive them shortly. If they arrived safely, he would try them in Queensland. As to the statement that the islands Fraslin, Curieuse, and Ile Ronde had been considered by General Gordon to be the original Garden of Eden, he thought this was an error. The General had merely speculated on the possibility of such having been the case, but had alleged nothing. He had seen and verified the unpublished monograph by General Gordon on the Coco-de-Mer, which was very complete, the General having been an excellent draftsman, and having probably had the assistance, as to the botanical items, of his friend Mr. Scott, of Mauritius, with whom he had lived for some time.

Mr. GRIFFITHS said that two points had been referred to by Mr. McCrae, which he thought were of some interest. The first had reference to the very limited distribution of the tree, and the second to the geological character and features of the island upon which it was found. Far apart as the two subjects seemed to be, there was a connection between them. It was very singular that the Coco-de-Mer should be found on three islands and nowhere else in the world, and naturally such a fact had given rise to a great deal of speculation; but they had sufficient knowledge of the geology of the globe to have some idea, at any rate, of the steps by which such a condition of things had arisen. It was tolerably well established that, during the mesozoic period, there had been a continent in the Indian Ocean. This continent had had a shape which might perhaps be readily represented by a boomerang, and had stretched from the Cape of Good Hope (which was then isolated from the rest of Africa) through Madagascar and the region now represented by the islands Fraslin, Curieuse, and Ile Ronde, and, possibly, as far north as India. The Southern part of India at that time had been isolated from what is now Asia, and deep seas had rolled where the Himalaya Mountains now stand. It had then turned, answering to the curve of the boomerang, and stretched out to Australia, which at that time consisted of two parts—Western and Eastern Australia, between which was a wide shallow sea, and which were probably cut off from each other more or less completely. The existence of this ancient continent had been suggested by certain features in connection with the distribution of the fauna and flora of the world to-day, and the curious affinities which existed between Western Australia, South Africa, and parts of India.

This continent, in the secondary period, had gradually sunk beneath the ocean, and only isolated parts of it, among which were the Seychelles Islands, yet remained above water. Nearly all oceanic islands were of volcanic origin, but there were a few here and there that were not entirely volcanic, and contained rocks such as granite. Granite was never exposed, except as the result of denudation, which had been proceeding for a long period, and was only found so exposed in a very few isolated instances. The Seychelles he understood to be one of these isolated instances. New Zealand was another, and there were a few more in the Atlantic. Such a phenomenon was very rare, and the fact that those rocks existed in the Seychelles, was technical evidence that they were the remains of a continent that once existed. There was no doubt whatever that the islands were remnants of what had once been an extensive continent, and in this fact was to be found a clue to the limited distribution of the *Coco-de-Mer*. For the development of such a plant, a large area of land was required. There was no fact in the range of natural history better established than that. There could be no doubt that the *Coco-de-Mer* was developed when it flourished on a large continent—the mesozoic continent. As the land gradually sank beneath the ocean, and the area of dry land became more limited, the distribution of the tree had become limited in a corresponding degree; and, owing to causes which possibly could not be explained, the *Coco-de-Mer* had become extinct in all parts of the ancient continent, with the exception of *Fraslin*. They had similar instances of plants undergoing such changes. There was one island—*Kerguelen*, upon which not a single tree could be found, and yet under the basalt were to be found the huge trunks of beech and pine trees, three and four feet in girth, together with any amount of coal. This island had formed part of a continent, and as the land had sunk, its conditions had changed until they were such that trees could no longer exist, and had therefore perished. The *Coco-de-Mer* had probably perished in like manner, as all portions of the continent disappeared, until at last its remains were only to be found in *Fraslin*, and its stumps and roots, that had recently died in the small islands *Ile Ronde* and *Curieuse*. The peculiarities of the geology of the island were easily explained. They were not the result of catastrophies, as General Gordon had supposed, but were caused simply by the island slowly subsiding beneath the ocean.

Mr. McCRAE, in reply to the President, said that some portions of the nut of the Coco-de-Mer were good for food, but were very insipid unless taken with sugar or wine. The nuts when polished were very beautiful, and were in two different colours—ebony and jasper. This difference in the colouring, however, he suspected to be a trick of the native jewellers.

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*Thursday, November 13th.*

Mr. E. J. WHITE (Vice-President), in the chair.

The minutes of the preceding meeting were read and confirmed.

Messrs. C. N. Hake and C. G. W. Officer were balloted for as Members, and Messrs. N. T. M. Wilsmore, Elderson Smith, and Mrs. Elderson Smith as Associates, and declared to be duly elected.

Mr. Frank Goldstraw was nominated for Membership.

In the absence of Dr. Neild, the Hon. Librarian, the Report was read by the Chairman, and showed that 104 publications had been received from various parts of the world.

#### ANNUAL ELECTION OF COMMITTEES.

Gravity Survey Committee.—Mr. Love moved “That the Committee, consisting of Mr. Ellery, Professors Kernot, Masson, and Lyle, Mr. White, and Mr. Love (Secretary), with power to add to their number, appointed to consider and report upon a suggested Gravity Survey of Australia, be re-appointed.” Carried.

Publishing Committee.—Mr. Griffiths moved “That the Publishing Committee for the following year consist of Messrs. Ellery, Griffiths, Masson, and Spencer.” Carried.

Biological Survey Committee.—Professor Spencer moved “That the following Members form the Biological Survey Committee for the ensuing year: Wm. Bale, F.R.M.S., Rev. A. W. Cresswell, M.A., A. Dendy, D.Sc., A. H. S. Lucas, M.A., B.Sc. (Hon. Sec.), P. H. MacGillivray, M.A., M.R.C.S., Professor W. B. Spencer, M.A., C. A. Topp, M.A., LL.B., F.L.S., J. Bracebridge Wilson, M.A.”

Antarctic Exploration Committee.—Mr. Rusden moved the re-appointment of the Antarctic Exploration Committee, consisting of Mr. Ellery, Mr. Griffiths, Professor Kernot, Mr. Rusden, Dr. Wild, Dr. Bride, Mr. J. G. Duffy, Mr. H. Gundersen, Mr. E. J. Hart, Mr. A. C. Macdonald, Baron Ferdinand von Mueller, K.C.M.G., Captain Pascoe, R.N., and Mr. Sachse. He said that the Committee had received letters through Mr. Gundersen, the Swedish Consul, from the Swedish Academy, offering on the part of Barons Nordenskiöld and Dickson to form a Swedish-Australian Expedition, provided that Australia would contribute the sum of £5000 towards it, and Baron Nordenskiöld undertook to lead it. The Committee had accepted the offer and promised to endeavour to collect the £5000 as soon as possible. Subscription lists had been prepared, and were now being circulated, headed by donations already promised amounting to £600 which sum would probably be augmented that evening by a vote of the Royal Society of £100. Preparations were in progress for giving a Grand Ball, by which it was expected that the Exploration Fund would acquire a fair accession, but more was expected from persons in positions like that of Sir Thomas Elder, who had offered £5000 towards Central Australian Exploration, and, if the cablegrams could be relied on, had since offered a like sum towards Antarctic Exploration. Several persons looked upon this Expedition as peculiarly the duty of Australia, and the number of persons who were acquiring a lively interest in it was daily increasing. If Sir Thomas Elder's offer were available for the proposed Swedish-Australian Expedition, the enterprise was almost a prospective certainty, as the amount required from Australia by the Barons was exceeded and Baron Dickson was understood to be prepared to furnish what more might be required.

Professor SPENCER enquired whether it was proper to appoint a Committee formed partly of Members of the Royal Society, and partly of gentlemen who were not Members.

Mr. RUSDEN said that this was a Joint Committee consisting partly of Members of the Royal Society, and partly of Members of another Society.

Professor SPENCER wished to know whether a Committee of the Society had power to add to its number gentlemen who were not Members of the Society.

Mr. WHITE thought the original intention was, that Committees should be composed only of Members of the Society.

Mr. BLACKETT thought that only Members of the Royal Society should be nominated. If other Societies coalesced with that Committee, that would be quite right; but he thought it *ultra vires* for the Society to nominate other gentlemen.

Mr. GRIFFITHS explained that the Royal Society nominated a certain number of gentlemen, as did also the Royal Geographical Society, and both Societies had agreed in conferring upon this Joint Committee the power of adding to their number; in consequence of which, certain gentlemen had been afterwards added to that Committee. The question now arose, should this Committee be re-appointed *in globo*, or only those gentlemen formerly appointed by the Royal Society, leaving the gentlemen on the Committee who were Members of both Societies to afterwards re-appoint the gentlemen who were outside.

The Chairman, Mr. WHITE, said they could simply appoint their own members, and if the Committee cared to appoint other gentlemen to co-operate with them, they would have power to do so. He would certainly withdraw from the list any who were not Members of the Royal Society.

Mr. GRIFFITHS said there was a possibility of the Geographical Society appointing a different Committee this year.

The Chairman, Mr. WHITE, said that if the Royal Society simply appointed their Committee, the Geographical Society might nominate theirs, and the Joint Committee could nominate other gentlemen.

Mr. RUSDEN said that the Royal Society had formerly nominated Professor Ellery, Mr. Griffiths, Professor Kernot, Dr. Wild, and himself. It would be sufficient to again nominate those gentlemen, and they would have power to add to their number if they thought proper.

This was agreed to and carried.

House Committee.—Mr. Rusden moved "That the House Committee, consisting of Mr. Blackett, Professor Kernot, Dr. Neild, Professor Masson and Mr. Rusden, be re-appointed." Carried.

THE ROYAL SOCIETY'S SUBSCRIPTION TO THE ANTARCTIC  
EXPLORATION FUND.

Mr. ALEXANDER SUTHERLAND, on behalf of the Council, moved, "That the sum of £100 be subscribed out of the funds of the Royal Society to the Antarctic Exploration Fund." He said he would like to enlist the sympathies of the Members of the Royal Society in favour of this movement. With one or two trifling exceptions, such as Northern Burmah and the back portions of some rivers of Brazil, every part of the world had been properly explored, but that near the South Pole, and this made a big blank indeed in the map of the world, and left it lamentably deficient. He would enlist the sympathies of the Members in the proposed scheme from a purely scientific point of view, purely for the love of science. Whale and seal fisheries might find a place, so to speak, in the tail of the movement; but if they had a divided interest in the matter, he thought the issue less likely to be satisfactory. Science, if properly carried out, never was barren of results, but those which followed, had generally been found to be the very opposite to those which had been expected. He would, therefore suggest, that they should go on simply for the love of science, and leave the beneficial results to follow in what shape they would. They had the chance of securing the services of Baron Nordenskiöld, and it would be a very culpable thing if Australia were to let it slip. If Sweden, a nation certainly not superior to our own in resources, had done so much in the way of this class of exploration, surely it would be a slur on Australia, if it did not do the same amount of work for a region that lay close at hand. A number of scientific problems were awaiting solution in the Antarctic region, and there were probably 4000 or 5000 miles of coast to explore. It had been said that the South Pole must be buried under a mass of twenty miles of solid ice. If this could be proven, he thought it would appeal to anyone as being well worth the expenditure of a few thousand pounds to place such a fact upon a safe basis. There were also many other phenomena to study, and in short, we in Australia should be missing a very great chance of assisting in the scientific exploration of the world, if this scheme were not taken up. We should be also missing the opportunity of putting into the national pulse a strong beat of national life; because he did not think that anything

would really bind Australia so well together, as working for a common object, an object that would fire the national enthusiasm, so that all communities would feel interested in what Australia was doing. For these reasons, he would like to see the Society take the matter up. He would suggest a little alteration in the form of the motion. The Council had been unanimous in its decision. The money could not very well be spared, but in view of the immense results that were expected to follow, and the national character of the scheme, the Council was willing to stretch a point, and the Treasurer had stated that he was in a position to honour a cheque. He would rather, however, that the money should be left in the control of the Council, to be given by the Council on such conditions as it might think fit, so that, if any hitch should occur, the money should not lie locked up in a fund, *ad infinitum*. He, himself, had given a subscription five years ago to a project which had not yet come off, and the money had been lying idle all the time. Even Mr. Griffiths could not guarantee that the thing would be carried through, and their £100 might be paid into some fund, and lie there for the next twenty years. He had great pleasure in proposing the resolution.

MR. GRIFFITHS said he had very much pleasure in seconding the motion, and cordially supported all that Mr. Sutherland had said. Australia had shown herself very energetic and successful in the pursuit of material advantages, but on this occasion, they were asking the people of Australia to support a scientific project, purely for the sake of science. It was a project which, certainly, ought to be carried out by Australia, for the area which it was proposed to examine, lay within a week's sail of our shores. Baron Oscar Dickson had offered to send out this expedition, if Australia would find £5000 towards the cost of it. He (Mr. Griffiths) had gone into some detail with reference to this matter, and he was of opinion, that if two ships were sent out, although one of them was but a small vessel, the work could not be done for a less amount than £20,000. Baron Oscar Dickson had stated that he might be able to raise £5000 in Sweden; still his offer to send the Expedition if Australia would find £5000, meant that he himself would find £10,000, which was a very liberal offer. The Baron, however, was a very liberal man, and had already at his own cost, sent out seven different Expeditions to the Polar Regions. He was not, therefore, likely to be daunted by

the expense of the Expedition ; and although the offer came from Sweden, they might be proud of the fact that the Baron himself was an Englishman.

Mr. DENDY suggested that some condition should be attached to the granting of the money. Would it not be possible that the Royal Society should be allowed to nominate a Member of the Expedition in consideration of the grant of £100 ?

Mr. GRIFFITHS said that this matter had not been lost sight of by the Antarctic Committee. The Members of the Committee were all fully seized of the desirability of having representatives, and the Royal Society was so strongly represented on the Committee, that he thought it might very safely leave the charge of this matter to those who had the Society's representation in their hands. He felt this more strongly because, if they took the stand suggested by Mr. Dendy, it would virtually amount to the Royal Society saying that by virtue of contributing £100 out of an expenditure of £20,000, it demanded the right of nominating a representative. If everybody contributing a similar sum could make a like demand, they would have a very good crew. However, it was the intention of the Committee to arrange with Baron Nordenskiöld for power to nominate one or two gentlemen. The Committee also hoped to have the power of reserving cabin accommodation for representatives of the Press, because an Expedition of this sort ought to have its historian ; the Press of Australia was energetic and he was quite sure it would not like to miss the opportunity of sending a gentleman who would be able to contribute an interesting account, apart from the scientific record. These matters had not been lost sight of, and he thought they should be left in the hands of the portion of the Committee representing the Royal Society.

Mr. BLACKETT quite agreed with what Mr. Griffiths had said, as regarded the inconvenience of making the vote conditional, and thought they might leave it to the Antarctic Committee to see that Australia was properly represented. With regard to the offer by Sir Thomas Elder, liberal as it was, he did not think that it should make the Members shut up their purses, either as the Royal Society or private individuals. He thought that not only should the Society give what it could out of the funds, but that the Members should also make an effort to give something to show their personal

interest in this scientific expedition. If they gave what they could afford, whatever it was, it would be an evidence to Baron Oscar Dickson, and those who took an interest in the matter, that Australia was bound to support them in a generous way.

Mr. RUSDEN thought the offer of Sir Thomas Elder of immense advantage, it being a splendid example to a great many in Australia who were in a position to do the same thing. At the same time, he did not know that they could rely upon anything that only appeared in a telegram, without corroboration. He might also mention that in a letter to the Swedish Academy accepting so far as was possible Baron Nordenskiöld's offer, although it was stated that no doubt he would have the right to take with him whom he would, yet the names of Professor Spencer and Mr. Wragge, of Brisbane, were mentioned as candidates to accompany the Expedition, in terms which would show that they were suitable persons, and quite as good as any he could find. He therefore thought the objects suggested by Mr. Dendy had been conveyed in more delicate terms.

Mr. DENDY asked to be allowed to withdraw his motion, as he thought it had been made sufficiently clear that it was unnecessary.

The motion, as proposed by Mr. Sutherland, and seconded by Mr. Griffiths was then put and carried unanimously.

A MEMBER moved, "That the Secretaries be instructed to send out circulars to the Members for private subscriptions." He thought a good many subscriptions could be obtained in that way. He would like also that subscriptions which came from Members of the Society should go into a common fund, and should appear as Royal Society subscriptions. This resolution was carried.

A paper entitled "A Description of New and Little-known Polyzoa, Part XIV," by Mr. P. H. MacGillivray, M.A., M.R.C.S., was described to the meeting by Mr. Wilson, and taken as read.

A paper entitled "The Dukduk Association of New Britain," by the Rev. R. H. Rickard, presented by the Rev. Lorimer Fison, was read by Professor Spencer.

Mr. BLACKETT said it would be interesting to know whether the English word "taboo" had had its origin in

some way from the rites and customs of the natives in that part of the World.

The Chairman (Mr. WHITE) said that the word had not been known before Captain Cook's description.

Mr. SUTHERLAND said that this custom, or something nearly approaching it, was found all over the World. Bates in his "*Travels in Amazon*," Wallace and other authors had described the same thing. It started apparently from the childish idea of putting on masks; but when it was found that people could be frightened, the proclivities of the natives in the direction of the suggestion of supernatural causes had led to this custom becoming semi-religious in character.

Mr. WILSON said that Dukduk was mentioned in a recent work by Fraser, wherein it was described as a ceremony marking the passage from boyhood to manhood. According to Mr. Fraser, its chief feature was a representation of death and resurrection, the young fellow who was to be initiated receiving a blow which was supposed to cause his death, and certain ceremonies afterwards being preformed which were supposed to bring him to life.

A paper "*On Two Rare Hydroids from Port Phillip*" was read by Professor W. Baldwin Spencer, who illustrated his remarks by a number of charts and blackboard drawings.

Mr. DENDY remarked that it was not surprising that Dr. Gray had described the *Ceratelladæ* as sponges, as in external appearance they bore the strongest resemblance to some of the horny sponges. Not only was this so, but the skeleton of the *Dehitella*, and that of certain horny sponges, were almost identical. Mr. Carter had decided that they were not sponges, because he had found thread cells in them—thread cells being characteristic of hydroids. Another worker had found thread cells in an undoubted sponge, and had therefore jumped to the conclusion that sponges contained thread cells; but it had been found later on that the thread cells did not belong to the sponge, but to a hydroid parasitic upon the sponge. This had led him (Mr. Dendy) to think that it was not altogether impossible that these might be composite forms—a combination of a dead sponge with a hydroid growing parasitically upon it. Horny sponges had skeletons very similar to those of the hydroids just described. Dr. Schulze in his "*Challenger Report*" described a hydroid parasitic. Dr. Gray thought that the

forms were sponges, and Mr. Carter thought they were hydroids. Was it not possible to reconcile these different views? He thought it probable that originally it was a sponge upon which a hydroid was parasitic, and that the hydroid grew so as to kill the sponge, and then remained master of the situation.

Professor SPENCER said that, although there was no doubt whatever that hydroid forms did live parasitically upon sponges, and that therefore the suggestion was rather a taking one at first sight, still the balance of evidence was strongly against this theory in the case of *Dehitella* and the form now described, which, in their skeleton, were very similar in many respects to *Hydractinia*, and were undoubted hydroids.

An Appendix to remarks on "The Older Tertiary Strata at Bairnsdale" was read by Mr. John Dennant, F.G.S.

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*Thursday, December 11th.*

The President in the chair.

The minutes of the preceding meeting were read and duly confirmed.

Mr. Grayson and Mr. Best, as Associates, and Dr. Syme, as a Member, signed the Roll, and were introduced by the President to the meeting.

Mr. Alfred Reeve was nominated as a Member.

Mr. Frank Goldstraw was balloted for as an Associate, and declared duly elected.

#### NOMINATION OF OFFICE-BEARERS AND MEMBERS OF COUNCIL.

The President (Professor KERNOT) stated that the offices of President, Treasurer, Secretary and Librarian, as well as three vacancies in the Council, would have to be filled by ballot at the next General Meeting, which would be held in March. Nominations might be sent in at any time before the first day of March, by letter addressed to one of the Secretaries; but it was better that Members, if they took any special interest in the matter, should send in their nominations at once. The following were the names of the retiring Officers and Members of Council:—President—

Professor Kernot; Vice-Presidents—E. J. White, F.R.A.S., and J. Cosmo Newbery, C.M.G.; Treasurer—C. R. Blackett, F.C.S.; Librarian—J. E. Neild, M.D.; Secretaries—H. K. Rusden and W. Baldwin Spencer, M.A.; Members of Council—A. W. Howitt, F.G.S., J. Jamieson, M.D., A. H. S. Lucas, M.A., B.Sc., Professor Lyle, M.A., A. Sutherland, M.A., and A. S. Way, M.A. The non-retiring Members were:—R. L. J. Ellery, F.R.S., G. S. Griffiths, F.G.S., Professor Masson, M.A., D.Sc., and H. Moors. Two vacancies for lapsed seats also required to be filled.

Dr. NEILD moved the re-election of Messrs. Fenton and Moors as Auditors.

Mr. RUSDEN seconded the resolution, which was put to the meeting and carried.

Dr. NEILD, the Hon. Librarian, reported that 110 volumes had been received since the preceding meeting.

Mr. DENDY read a paper entitled "Monograph of the Victorian Sponges, Part I. The Anatomy and Classification of the Calcareous Homocœla, with Description of the Victorian Species," illustrating his remarks by a number of diagrams and blackboard drawings. At its conclusion, Mr. Dendy was accorded hearty applause.

The PRESIDENT said that Mr. Dendy had not only succeeded in bringing to light a number of interesting facts in connection with the sponges he had described, but also in rendering them clear to those who were not experts. There was something exceedingly attractive in the study of these low forms of life; and it certainly was interesting to learn that on Victorian shores a sponge had been found presenting a structure as to which the best Spongologists had been sceptical, and of a size rendering it capable of easy examination. He congratulated Mr. Dendy, not only on the interesting discoveries he appeared to have made, but also upon the admirable diagrams that he had specially prepared for their enlightenment that evening.

Professor SPENCER said it was almost impossible to discuss such an interesting and valuable paper at short notice. Mr. Dendy was to be congratulated on the commencement of his work on sponges. When he would bring it to a close, he could not tell, seeing the large number of specimens on which he was engaged; but he hoped that the Society

would be able to publish his work in full, and to devote at all events, one volume of its Transactions to it. It would be perhaps one of the most valuable papers the Society had published. Mr. Dendy's remarks, especially with regard to classification of the groups, were very interesting as showing that there were three gradations in form to be met with among the different members of the group *Calcareo Homocela*; and that it was practically impossible to divide them into a series of species clearly marked off from one another, but that they were to be regarded simply as varieties of one group, more or less complicated. Perhaps one of the most interesting points was, the curious modification by which the collared cells in one of the types described, seemed at first sight to have changed their positions with regard to the tubes, the walls of which they lined. Mr. Dendy's diagram had taken a considerable amount of thinking out, and, from what he (Professor Spencer) had seen of the specimens, accurately represented what really took place. There were a number of other interesting points to which he would like to allude, but it was practically impossible to discuss such a paper on the spur of the moment. He could only congratulate Mr. Dendy and the Society on the work which had been done.

The PRESIDENT thought that Mr. Dendy had not given full information as to the dimensions of the specimens he had described. Of course, in a diagram, things were drawn to various scales, and the relative sizes could not be at once understood.

Mr. DENDY, in reply, said he had worked out the dimensions of a number of forms. The collared cells were extremely minute, and were invisible to the naked eye. The largest spicules were just visible. The inhalent pores were invisible to the naked eye, and required a fairly high power microscope to define them distinctly.

Professor SPENCER then read a paper entitled, "Notes on some Victorian Land Planarians."

At its conclusion,

The PRESIDENT remarked, that the present addition to the information they already possessed appeared to be very interesting. The district from which the specimens had been obtained was characterised by a high rainfall, dense

vegetation, and high altitude above the sea. He would like to know, whether Professor Spencer had traced any effect of the altitude above the sea on the distribution of the species. The district which had been visited averaged about 3000 feet above the sea and was noted for a comparatively heavy rainfall. It was a curious thing that such an animal, apparently so soft and feeble, should be able to destroy the formidable beetle, with its hard armour and sharp claws. The description of its proceedings reminded one of a boa-constrictor dealing with a bullock. It would be interesting to know whether the unfortunate beetle made any desperate attempts to rend its persecutor, or whether it succumbed to its fate.

Professor SPENCER said that, with regard to the forms procured from the special district in question, they were notable for being nearly all dark coloured, the light coloured species being remarkably absent. As to their food, the *Geoplanas* undoubtedly kill a great number of beetles.

Mr. HOGG said it was interesting to see the number of new species which were the result of almost every expedition made by Professor Spencer and Mr. Dendy. He thought the reason why they had not seen so many of them before, was because sufficient attention had not been given to them. He himself could testify to the large number of creatures which these worms eat. He had placed some planarians and moths together in a box, and a large moth, nearly two inches long in the body, had been completely cleared out by three or four planarians. With reference to what the Professor had said about the classification of the planarian according to the even or odd number of its stripes, this was a matter to which he had always felt some difficulty; because, although the body shapes were very persistent indeed, it always seemed to him that the stripes were not nearly equally so. The Professor had clearly shown the difference between the species, but he had often found that the stripes in what appeared to be the same species were very faint, and sometimes hardly existant. There were indications of them at one end of the planarian possibly, but they were not always persistent down the planarian, and seemed to him to vary considerably. This was a matter that wanted a good deal of consideration before it could be shown that the persistency was so great that the species were to be determined by it. The colours certainly varied in some small degree, and he

thought this depended a good deal on the nature of the shade in which they lived. When some were found living more out in the open than others, their colours were very much more brilliant. The colours of those found living in more shady places were not so brilliant. Another curious point was the large number of different species often found huddled together beneath the same log. In this position he had frequently found as many as four, and sometimes five species; and this at first had seemed to him a strong reason for believing that their stripes were not an indication of their different species. However, since he had seen how persistent the shapes of the body were with the stripes, he had come to consider that the stripes should have much more weight attached to them. Still, they very often disappeared; the thin ones certainly did, and therefore he thought they were hardly sufficient to make a classification by.

Mr. DENDY said that the main point was, that the species were distinguishable, and that the planarian could very easily be identified. All the old species had been identified at a glance. The stripes varied a little in distinctness, but the body shape and arrangements seemed to be always constant, and the position of the external apertures were good guides. The external appearances were quite sufficient to enable one to define the species. As yet, only one species had been worked out anatomically, but it was hoped that this work would be continued, when it would be shown how the internal anatomy agreed with the external appearances. Professor Von Graff had written to him, informing him that he was writing a Monograph, and he (Mr. Dendy) had sent him thirteen species. He had received a letter from the Professor stating that he was cutting these specimens into sections, and it was therefore hoped that his observations would be able to appear together with their own, so that a better idea would be gained as to how far planarians are recognisable as distinct species. With regard to the different species occurring in different localities, it was a striking fact that every region seemed to have its particular planarian fauna. There seemed to be a particular set of planarians characterising each district.

Mr. RALPH then read a paper entitled, "Observations and Experiments on the Coloured Material of the Red Corpuscles."

At its conclusion,

Dr. NEILD said that Mr. Ralph had raised the question—To what end? One might put the same question perhaps to most of the investigations which, having been worked out, had eventuated in remarkable practical benefit to the world at large. One point which impressed him was, should we in this way discover some method of treating those diseases in which these molecular changes take place? Without doubt, there was a very remarkable change in the corpuscles of the blood in many of the diseases that had engaged the attention of the medical profession and the scientific world generally, many of which were practically hopeless of treatment. He hoped that Mr. Ralph would attain the end at which he aimed, and that one day he would be able to say, by examination of the blood of a patient, from what particular disease he was suffering, and to determine with mathematical exactness what treatment to adopt. He was sure that every credit would be given to Mr. Ralph for the extraordinary industry and perseverance he had shown in this matter.

Dr. JAMIESON said that the changes observed by Mr. Ralph, were partly chemical and partly physical. He would have been better pleased if Mr. Ralph had recognised more specifically the fact that hæmoglobin was simply a soluble substance, capable of being crystallised and entering into chemical compounds, oxydised and de-oxydised; and, so far as he understood our knowledge to go, was a substance diffused through the corpuscle, and capable of escaping from the corpuscle into the liquid element of the blood. How far the concentration of the diffusion could be regarded as being due in any way to an independent action of the hæmoglobin itself, he had not been able to understand from the observations of Mr. Ralph, who seemed to speak of it as something capable of undergoing or exercising active changes, and not (as it seemed to him) as something passively diffused, perhaps in the corpuscle itself, perhaps round about it. He did not understand very well what particular significance Mr. Ralph attached to the hæmoglobin, what he recognised it to be, or what influence it was supposed to exert; whether he considered it something different from what it was generally supposed to be, viz., a chemical substance, capable of solution in water, and probably diffused through the stroma of the red corpuscle. There was no

doubt whatever about the amount of work that had been devoted to these experiments, and as all work honestly carried out led to some useful result, he hoped that this would also lead to something beneficial. The experiments, however, seemed somewhat disconnected, and did not give one an idea of what they were leading up to, and he would be glad if some generalisation could be obtained.

Mr. RALPH, in reply, said that he called the hæmoglobin the coloured material of the red corpuscle, in order to simplify the matter. He was satisfied that all the changes were due to the same material. As to generalising, these were his experiences in the rough. He had found comparatively similar results in typhoid and scarlatina, and lately in diphtheria blood. He had also experimented with the blood in cases of leprosy. In all these cases, the same disturbance took place in the coloured material. In such cases, there was an action on the blood analogous to the violent action of nitric or any other acid, and he would be very glad at any time to show these experiments to any one, more especially to his professional brethren.

The PRESIDENT stated that the question of the Antarctic Expedition was progressing favourably. For the purpose of procuring funds, a ball was being organised, and would take place on the 19th inst., under the patronage of His Excellency the Governor. He hoped that the members would do all in their power to help forward the movement in any way that met with their approval. Of course, it might perhaps be said that balls were not scientific proceedings, but the question was, how to get a sufficient amount of money to put beside Baron Dickson's grand offer. £5000 would have to be raised very shortly, if preparations were to be made for starting the Expedition next summer, and it was highly desirable that it should not be delayed later than that. He believed that a good deal of sympathy and assistance would be received from other colonies, but there was no shutting our eyes to the fact, that the brunt of the movement—the bulk of the burden—would have to be borne on Victorian shoulders. He hoped Members would do all they could to help this matter forward. There was an immense number of interesting points in Biology, Meteorology, Geography, and many other sciences to be determined by such an Expedition. It was now a very great many years since anything like a

properly equipped Expedition had found its way into high Southern latitudes. The "Challenger" had not gone so very far South, although it went within sight of the ice barrier. It was hoped that this Expedition would be able to get a good deal further South than any vessel had gone within the last forty years, if indeed it did not go further South than any vessel ever yet had gone. One reason for expecting this was, that the vessels would have steam power. In the high Southern latitudes comparative calms or light winds prevailed, and the sailing vessels were comparatively powerless and unmanageable. A steamer could go and return where a sailing vessel could not venture. To attempt the South Polar regions by the aid of steam power, was the object of the Expedition. £5000 had to be contributed by the Colonies, and the amounts promised and received in Melbourne were approaching £1000. This was not a great way towards £5000. He did not know exactly how far the matter had got in the other Colonies. This was the position the Antarctic question was in, and he trusted that Members of the Royal Society would render every assistance to this most desirable object.

In conclusion, he would again remind them that this was the last meeting of the year, and that they were about to enter on their long vacation. The next meeting, which would be held in the following March, would be the Annual Meeting, at which the Annual Elections would take place, and he trusted the nominations would be sent in in due time. He thanked the Members for their attendance, and congratulated the Society on what had been a very satisfactory Session, thanks mainly to the labours of those interested in Biology. He would declare the Meeting and the Session of 1890 at an end.

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ENGLAND.

|                                              |     |     |            |
|----------------------------------------------|-----|-----|------------|
| Agent-General of Victoria                    | ... | ... | London     |
| Anthropological Institute                    | ... | ... | London     |
| Biological Society of Liverpool              | ... | ... | Liverpool  |
| Bodleian Library                             | ... | ... | Oxford     |
| British Museum                               | ... | ... | London     |
| Colonial Office Library                      | ... | ... | London     |
| "Electrician"                                | ... | ... | London     |
| Foreign Office Library                       | ... | ... | London     |
| Geological Society                           | ... | ... | London     |
| Institute of Mining and Mechanical Engineers | ... | ... | Newcastle  |
| Institution of Civil Engineers               | ... | ... | London     |
| Linneæan Society                             | ... | ... | London     |
| Literary and Philosophical Society           | ... | ... | Liverpool  |
| Marine Biological Laboratory                 | ... | ... | Plymouth   |
| Natural History Museum                       | ... | ... | London     |
| Naturalists' Society                         | ... | ... | Bristol    |
| "Nature"                                     | ... | ... | London     |
| Owen's College Library                       | ... | ... | Manchester |
| Patent Office, 25 Southampton Buildings      | ... | ... | London     |
| Philosophical Society                        | ... | ... | Cambridge  |
| Royal Asiatic Society                        | ... | ... | London     |
| Royal Astronomical Society                   | ... | ... | London     |
| Royal Colonial Institute                     | ... | ... | London     |
| Royal Gardens                                | ... | ... | Kew        |
| Royal Geographical Society                   | ... | ... | London     |
| Royal Microscopical Society                  | ... | ... | London     |
| Royal Society                                | ... | ... | London     |
| Statistical Society                          | ... | ... | London     |
| University Library                           | ... | ... | Cambridge  |

SCOTLAND.

|                                         |     |     |           |
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| Geological Society                      | ... | ... | Edinburgh |
| Royal College of Physicians' Laboratory | ... | ... | Edinburgh |

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|--------------------------------|-----|-----|-------------|
| Royal Observatory              | ... | ... | Edinburgh   |
| Royal Physical Society         | ... | ... | Edinburgh   |
| Royal Society                  | ... | ... | Edinburgh   |
| Royal Scottish Society of Arts | ... | ... | Edinburgh   |
| Scottish Geographical Society  | ... | ... | Edinburgh   |
| University Library             | ... | ... | Edinburgh   |
| University Library             | ... | ... | ... Glasgow |

IRELAND.

|                                           |     |     |         |
|-------------------------------------------|-----|-----|---------|
| Natural History and Philosophical Society | ... | ... | Belfast |
| Royal Dublin Society                      | ... | ... | Dublin  |
| Royal Geological Society                  | ... | ... | Dublin  |
| Royal Irish Academy                       | ... | ... | Dublin  |
| Trinity College Library                   | ... | ... | Dublin  |

GERMANY.

|                                                  |     |     |            |
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| Gartenbauverein                                  | ... | ... | Darmstadt  |
| Gesellschaft für Erdkunde                        | ... | ... | Berlin     |
| Grossh. Hessische Geologische Anstalt            | ... | ... | Darmstadt  |
| Königl. Botanische Gesellschaft                  | ... | ... | Regensburg |
| Königl. Offentl. Bibliothek                      | ... | ... | Dresden    |
| Königl. Preussische Akademie der Wissenschaften  | ... | ... | Berlin     |
| Königl. Sächs Gesellschaft der Wissenschaften    | ... | ... | Leipzig    |
| Königl. Societät der Wissenschaften              | ... | ... | Göttingen  |
| Naturforschende Gesellschaft                     | ... | ... | Emden      |
| Naturforschende Gesellschaft                     | ... | ... | Halle      |
| Naturforschende Gesellschaft                     | ... | ... | Leipzig    |
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| Naturhistorische Gesellschaft                    | ... | ... | Hanover    |
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| Naturhistorisches Museum                         | ... | ... | Hanover    |
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| Schlesische Gesellschaft für Vaterländ. Cultur.  | ... | ... | Breslau    |
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| Verein für Erdkunde                              | ... | ... | Halle      |
| Verein für Naturkunde                            | ... | ... | Kassel     |

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| K. K. Akademie der Wissenschaften | ... | ... | Wien |
| K. K. Geologische Reichsanstalt   | ... | ... | Wien |

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|                                     |     |     |        |
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| K. K. Geographische Gesellschaft .. | ... | ... | Wien   |
| K. K. Naturhistorisches Hofmuseum   | ... | ... | Wien   |
| Imperial Observatory ...            | ... | ... | Prague |

SWITZERLAND.

|                                                 |     |     |            |
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| Geogr. Commenc. Gesellschaft                    | ... | ... | St. Gallen |
| Geogr. Commenc. Gesellschaft                    | ... | ... | Aarau      |
| Schweizerische Naturforschende Gesellschaft     | ... | ... | Berne      |
| Société de Physique et d'Histoire Naturelle ... | ... | ... | Genève     |

FRANCE.

|                                                 |     |     |           |
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| Académie des Sciences et Belles-Lettres et Arts | ... | ... | Lyon      |
| Feuilles des Jeunes Naturalists                 | ... | ... | Paris     |
| Société Académique Indo-Chinoise                | ... | ... | Paris     |
| Société de Géographie                           | ... | ... | Paris     |
| Société Nationale de Cherbourg                  | ... | ... | Cherbourg |
| Société Zoologique de France                    | ... | ... | Paris     |

ITALY.

|                                                    |     |     |         |
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| Biblioteca Nazionale Centrale Vittorio Emanuele    | ... | ... | Rome    |
| British and American Archæological Society         | ... | ... | Rome    |
| Museo di Zoologia ed Anatomia Comp., R. Università | ... | ... | Turin   |
| Ministero dei Lavori Pubblici                      | ... | ... | Rome    |
| Reale Academia di Scienze                          | ... | ... | Palermo |
| Reale Academia di Scienze, Lettere ed Arti         | ... | ... | Lucca   |
| Regia Academia di Scienze, Lettere ed Arti         | ... | ... | Modina  |
| Società Geografica Italiana                        | ... | ... | Rome    |
| Società Toscana di Scienze Naturali                | ... | ... | Pisa    |

SPAIN AND PORTUGAL.

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| Real Academia de Ciencias Exactas, Fisicas y Naturales | ... | ... | Madrid |
| Sociedade de Geographia                                | ... | ... | Lisbon |

HOLLAND AND BELGIUM.

|                                                      |     |     |           |
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| Bataviaasch Genootschap van Kunsten en Wetenschappen | ... | ... | Batavia   |
| Natural Science Society                              | ... | ... | Amsterdam |

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| Natuurkundig Genootschap                  | ... | ... | Groningen |
| Nederlandsch Botan. Vereeninging          | ... | ... | Nijmegen  |
| Magnetical and Meteorological Observatory | ... | ... | Batavia   |
| Société Hollandaise des Sciences          | ... | ... | Haarlem   |
| Société Macologique Royale de Belgique    | ... | ... | Bruxelles |
| Société Provinciale des Arts et Sciences  | ... | ... | Utrecht   |

DENMARK, SWEDEN, AND NORWAY.

|                                         |     |     |             |
|-----------------------------------------|-----|-----|-------------|
| Académie Royale                         | ... | ... | Copenhagen  |
| Kongelige Danske Videnskabernes Selakap | ... | ... | Copenhagen  |
| Société des Sciences                    | ... | ... | Christiania |

RUSSIA AND ROUMANIA.

|                                                 |     |     |                |
|-------------------------------------------------|-----|-----|----------------|
| Institut Météorologique de Roumanie             | ... | ... | Bucharest      |
| Jardin Botanique Impérial                       | ... | ... | St. Petersburg |
| La Soc. de Naturalists de l'Université de Kazan | ... | ... | Kazan          |
| Soc. de Naturalistes Kiew                       | ... | ... | Kiew           |
| Société des Naturalistes de la Nouvelle Russie  | ... | ... | Odessa         |
| Société Impériale des Naturalistes              | ... | ... | Moscow         |
| Société Impériale Russe de Géographie           | ... | ... | St. Petersburg |

INDIA AND MAURITIUS.

|                                      |     |     |           |
|--------------------------------------|-----|-----|-----------|
| Royal Asiatic Society, Ceylon Branch | ... | ... | Colombo   |
| Geological Survey of India           | ... | ... | Calcutta  |
| Madras Literary Society              | ... | ... | Madras    |
| Meteorological Society               | ... | ... | Mauritius |
| Natural History Society              | ... | ... | Bombay    |
| Royal Bengal Asiatic Society         | ... | ... | Calcutta  |

CHINA AND JAPAN.

|                                           |     |     |           |
|-------------------------------------------|-----|-----|-----------|
| Astronomical Observatory                  | ... | ... | Hong Kong |
| China Branch of the Royal Asiatic Society | ... | ... | Shanghai  |
| Imperial University                       | ... | ... | Tokio     |
| Seismological Society of Japan            | ... | ... | Tokio     |

CANADA.

|                                                 |     |     |          |
|-------------------------------------------------|-----|-----|----------|
| Canadian Institute                              | ... | ... | Toronto  |
| Geological and Natural History Survey of Canada | ... | ... | Ottawa   |
| Royal Society of Canada                         | ... | ... | Montreal |

UNITED STATES.

|                                                     |     |     |               |
|-----------------------------------------------------|-----|-----|---------------|
| Academy of Natural Sciences                         | ... | ... | Davenport     |
| Academy of Natural Sciences                         | ... | ... | Philadelphia  |
| Academy of Sciences                                 | ... | ... | San Francisco |
| American Academy of Arts and Sciences               | ... | ... | Boston        |
| American Geographical Society                       | ... | ... | New York      |
| American Philosophical Society                      | ... | ... | Philadelphia  |
| Bureau of Ethnology                                 | ... | ... | Washington    |
| Colorado Scientific Society                         | ... | ... | Denver        |
| Cooper Union for the Advancement of Science and Art | ... | ... | New York      |
| Denison University                                  | ... | ... | Ohio          |
| John Hopkins University                             | ... | ... | Baltimore     |
| "Kosmos"                                            | ... | ... | San Francisco |
| Maryland Historical Society                         | ... | ... | Baltimore     |
| Natural Academy of Sciences                         | ... | ... | Washington    |
| Office of Chief of Engineers, U.S. Army             | ... | ... | Washington    |
| Philosophical Society                               | ... | ... | Washington    |
| "Science"                                           | ... | ... | New York      |
| Smithsonian Institute                               | ... | ... | Washington    |
| Society of Natural History                          | ... | ... | Boston        |
| Society of Natural Sciences                         | ... | ... | Buffalo       |
| United States Geological Survey                     | ... | ... | Washington    |

MEXICO.

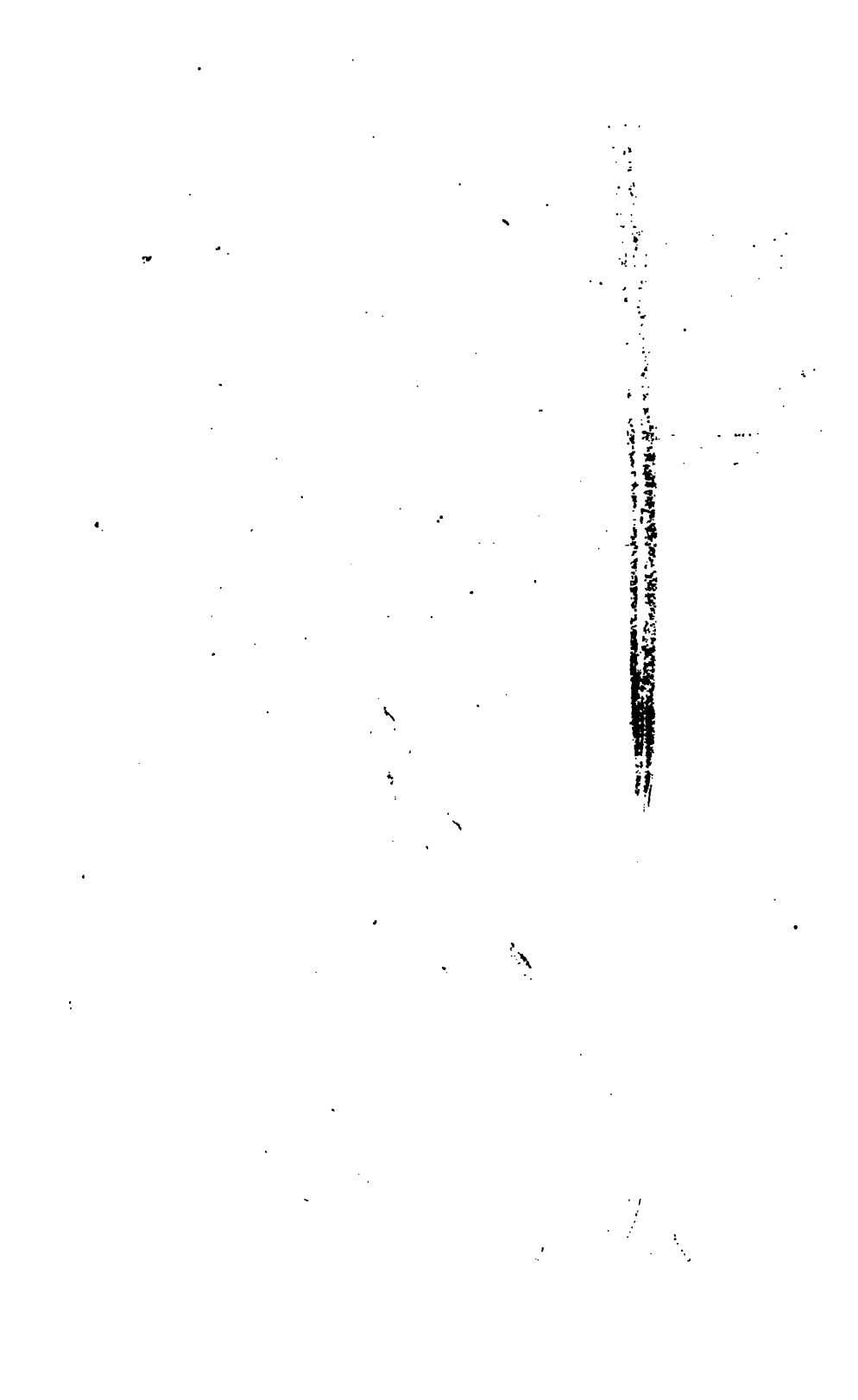
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|-----------------------------------------------|-----|-----|-------------|
| Ministerio de Fomento                         | ... | ... | Mexico      |
| Observatorio Meteorologico, Magnetico Central | ... | ... | Mexico      |
| Observatorio Astronomico National             | ... | ... | Tatubaya    |
| Sociedade Cientifica, Antonio Alsate          | ... | ... | Mexico      |
| Sociedad de Ingenieros de Jalisco             | ... | ... | Guadalajara |
| Secretaria de Fomento                         | ... | ... | Guatemala   |

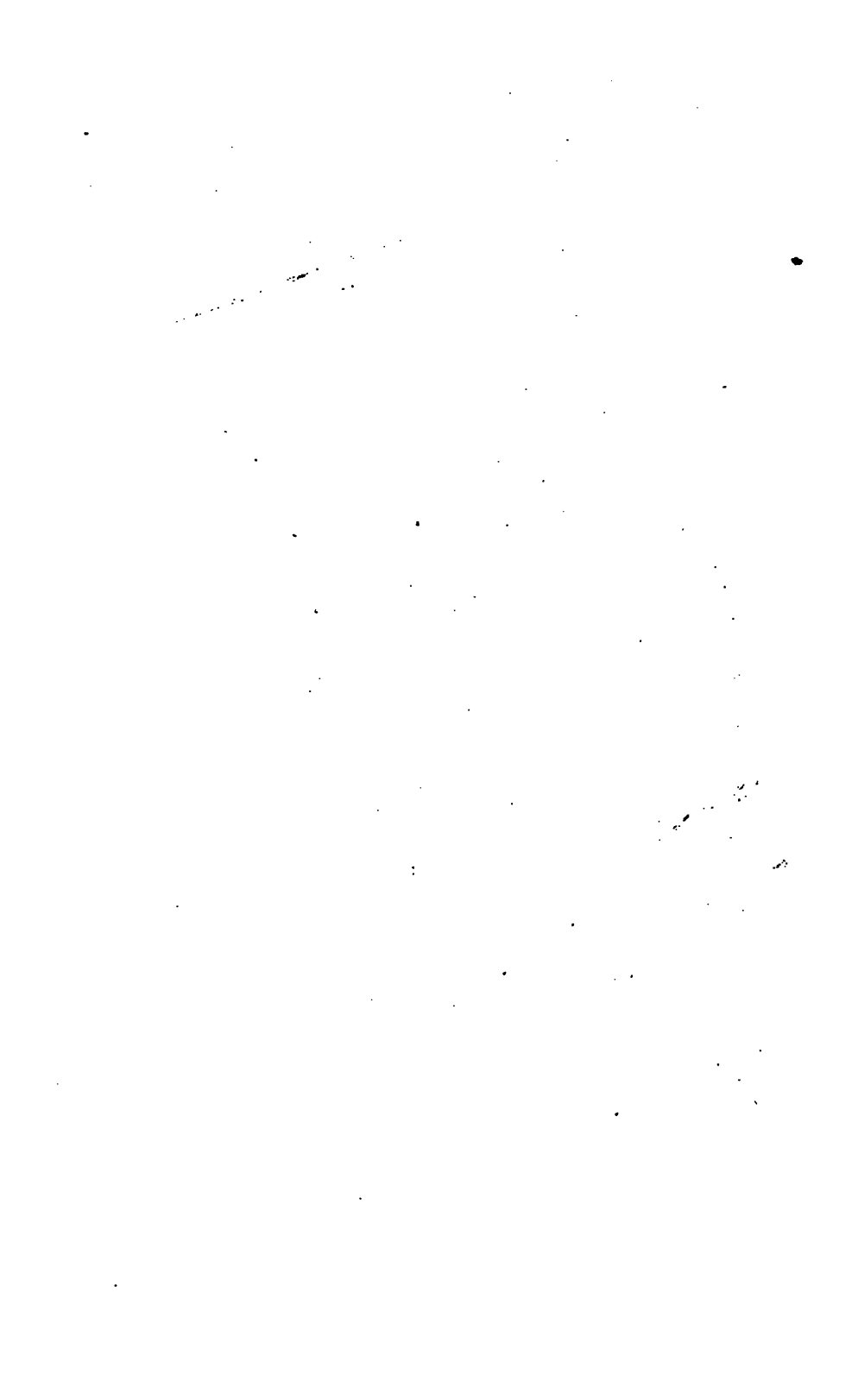
ARGENTINE REPUBLIC.

|                      |     |     |              |
|----------------------|-----|-----|--------------|
| Academia de Ciencias | ... | ... | Cordoba      |
| La Museo di Plata    | ... | ... | Buenos Ayres |

AUSTRALIA.—VICTORIA.

|                                  |     |     |           |
|----------------------------------|-----|-----|-----------|
| "Age"                            | ... | ... | Melbourne |
| "Argus"                          | ... | ... | Melbourne |
| Athenæum                         | ... | ... | Melbourne |
| Astronomical Observatory         | ... | ... | Melbourne |
| Australian Health Society        | ... | ... | Melbourne |
| "Australian Journal of Pharmacy" | ... | ... | Melbourne |
| Chief Secretary's Office         | ... | ... | Melbourne |



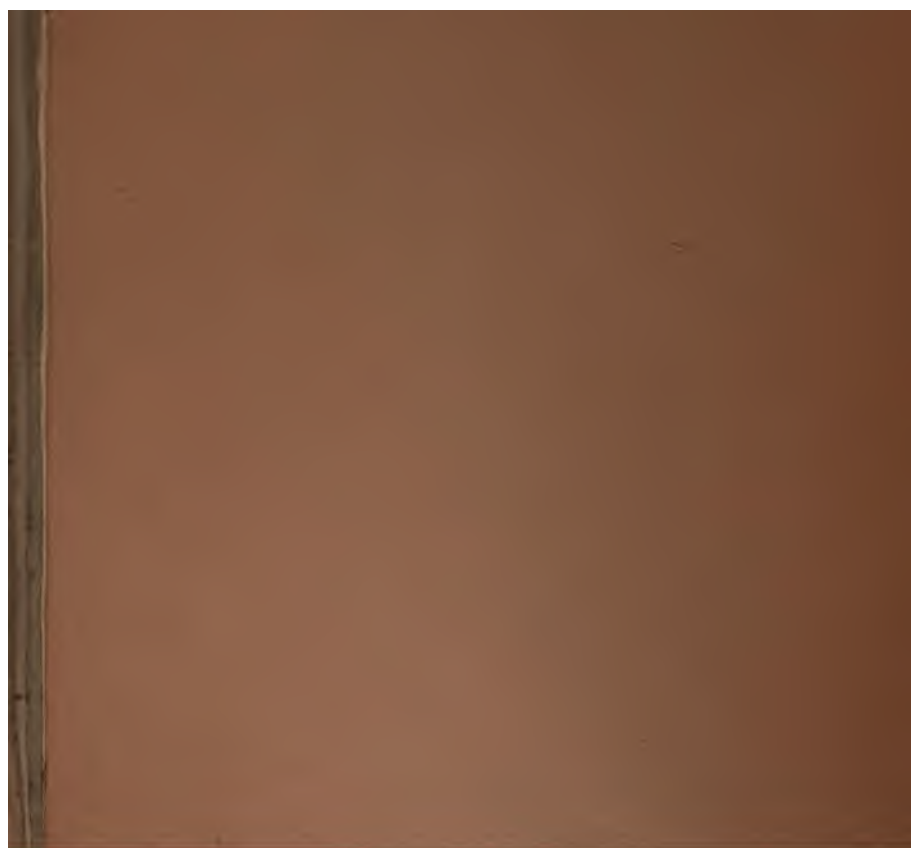












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